PROPANE

Aqua-Hot®

HYDRONIC HEATING SYSTEM

375-LP

WARNING: If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury, or death.

— **Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.**

— **WHAT TO DO IF YOU SMELL GAS**

- **Evacuate all persons from the vehicle.**
- **Shut off the gas supply at the gas container or source.**
- **Do not touch any electrical switch or use any phone or radio in the vehicle.**
- **Do not start the vehicle's engine or electric generator.**
- **Contact the nearest gas supplier or qualified service technician for repairs.**
- **If you cannot reach a gas supplier or qualified service technician, contact the nearest fire department.**
- **Do not turn on the gas supply until the gas leak(s) has been repaired.**

— **Installation and service must be performed by a qualified installer, service agency, or the gas supplier.**

SERVICE MANUAL

AHE-375-P02

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This manual is designed to aid trained and qualified service technicians with the process of troubleshooting and servicing the Aqua-Hot 375-LP Hydronic Heating System.

The Aqua-Hot features a 12 Volt-DC powered Propane-Burner and a 120 Volt-AC, 1500-Watt Electric Heating Element. These two heating sources are used in conjunction with an FDA approved "GRAS" (Generally Recognized as Safe) propylene glycol based boiler antifreeze and water heating solution in order to provide a continuous supply of domestic hot water, interior/fresh water tank heating, independent interior zone heating.

Please note that all Danger, Warning, Caution, and Note boxes, appearing as needed throughout this manual, must be reviewed and adhered to during servicing of the Aqua-Hot in order to avoid potential hazards which could result in injury, death, product damage, and/or property damage.

Should additional assistance be needed, please contact the Technical Support Department at 1-800-685-4298, Monday through Friday between the hours of 7:00 AM and 4:00 PM Mountain Standard Time.

Danger, Warning, Caution, and Note Box Definitions

Danger, Warning, Caution, and Note boxes appear throughout this manual as a means of alerting the service technician to important information.

⚠ DANGER! ⚠

Indicates that personal injury is likely or imminent

WARNING!

Indicates that serious damage to the heater will occur and personal injury is possible as well.

CAUTION:

Indicates that damage to the heater is possible.

NOTE: Indicates information that requires special attention by the service technician.

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Propane Burner, Heat Input (Firing Rate)..... 64,377 BTU/hr

Propane Burner, Fuel Consumption (Continuous Operation) .....0.72 gal/hr, 2.72 liters/hr

Heater, Voltage/Maximum Power Consumption.....12 Volt-DC/122 watts

Electric Heating Element specifications .....120 Volt-AC/1500 watts

Zone Heat Circulation Pump specifications .....(2) 12 Volt-DC/21 watts each

Number of Heating Zones.....maximum of 2, plus Bay Heat Exchanger

Domestic Water Heating Capacity.....continuous/on-demand

Dimensions .....16.75"H x 18"W x 29.5"L

Dry Weight..... approximately 155 lbs.

Wet Weight..... approximately 200 lbs.

NOTE: All vehicle installations must comply with the requirements listed in the Recreational Vehicle Industry Association's (RVIA) ANSI/NFPA 1192 Handbook for Recreational Vehicle Standards. To receive a copy of this handbook and other pertinent RVIA Standards, write to: Recreation Vehicle Industry Association, 1896 Preston White Drive, P.O. Box 2999, Reston, VA 22090-0999, call them at (703) 620-6003, or visit them online at www.rvia.org.

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For installation only in a compartment that is completely closed off from living quarters and accessible only from the outdoors.
The Exhaust System MUST NOT terminate beneath the vehicle or under an openable window or vent.
Combustion Air MUST BE supplied from outside the vehicle.
CAUTION: THIS APPLIANCE OPERATES ON BOTH AC AND DC POWER,
USE COPPER CONDUCTORS ONLY!
Use a 25-Amp fuse for over-current protection for the DC power supply.
Use a circuit breaker that cuts power at 20-Amps maximum for over-current protection for the 120-VAC power supply.
Mount the Heater near a bay/storage door so that the Access Cover can be easily removed for service.
WARNING: DO NOT OPERATE APPLIANCE WITH ACCESS COVERS REMOVED.

Minimum Heater Clearances:

Front—Open Access
Back— 0 inches
Top — 6 inches
Sides—0 inches

Install in strict compliance with local codes, NFPA 1192, and the manufacturer's instructions

Aqua-Hot®
HYDRONIC HEATING SYSTEM

For installation only in a compartment that is completely closed off from living quarters and accessible only from the outdoors.

Combustion Air MUST BE supplied from outside the vehicle.

Suitable for water (potable) heating and space heating.

USE COPPER CONDUCTORS ONLY!

Use a 25-Amp fuse for over-current protection for the DC power supply.

Use a circuit breaker that cuts power at 20-Amps maximum for over-current protection for the 120-VAC power supply.

Mount the Heater near a bay/storage door so that the Access Cover can be easily removed for service.

⚠ WARNING ⚠

DO NOT OPERATE APPLIANCE WITH ACCESS COVERS REMOVED.

RISK OF FIRE OR ELECTRIC SHOCK. ONLY CERTIFIED OR MANUFACTURER QUALIFIED SERVICE PERSONNEL SHALL BE USED TO INSTALL AND PROVIDE MAINTENANCE OF THIS APPLIANCE.

THIS APPLIANCE OPERATES ON BOTH AC AND DC POWER.

USE ONLY NONTOXIC PROPYLENE GLYCOL BASED BOILER ANTIFREEZE WITH ADDITIVES GENERALLY RECOGNIZED AS SAFE ("GRAS") BY THE FDA.

FAILURE TO WINTERIZE YOUR HEATER, WHEN STORED IN FREEZING TEMPERATURES, WILL RESULT IN SERIOUS DAMAGE TO THE PRODUCT'S DOMESTIC HOT WATER HEATING SYSTEM.

AIR PRESSURE APPLIED TO THE TANK MUST NOT EXCEED 20 PSI. EXCESS PRESSURE WILL RESULT IN INTERNAL DAMAGE.

FOR DETAILED INFORMATION, REFERENCE THE OWNER'S MANUAL OR CONTACT AQUA-HOT HEATING SYSTEMS INC. AT 1-800-685-4298.

Minimum Heater Clearances:
Front - Open Access
Back - 0 inches
Top - 6 inches

This appliance must be installed in accordance with local codes or, in the absence of local codes, the Standard for Recreational Vehicles, ANSI A119.2/NFPA 1192 or CAN/CSA-Z240 RV.

INTERTEK ETL LISTED C US
3069328

For Direct Vent Installation in a Recreational Vehicle.

Meets or exceeds ANSI Z21.10.1b/CSA 4.1b - 2006.

0 PSI Maximum Tank Pressure	5 gal Tank Capacity	.096 Orifice Size
92.5 Watts (DC)	1500 Watts (AC)	12.5 VDC, 7.4A Volts/Amps
120 VAC, 12.5 A, 50/60 Hz Volts/Amps/Frequency		64,377 BTU / 18.9 kWh Input Firing Rate
8" wc (in. H_2O) Minimum Inlet Pressure	10" wc (in. H_2O) Manifold Pressure	13" wc (in. H_2O) Maximum Inlet Pressure
AHE-375 Model Number	 Serial Number	PROPANE Fuel Type

15549 East Highway 52 • Fort Lupton, CO 80621 • 1.800.685.4298 • www.aqua-hot.com

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FOR YOUR SAFETY READ BEFORE OPERATING

WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device, which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. if the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Forced or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHE

AVERTISSEMENT. Quiconque ne respecte pas à la lettre les instructions dans la présente notice risque de déclencher un incendie ou une explosion entraînant des dommages, des blessures ou la mort.

A. Cet appareil ne comparte pas de veilleuse. Il est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.

B. AVANT DE FAIRE FONCTIONNER, reniflez tout autour de l'appareil pour déceler une odeur de gaz. Reniflez près du plancher, car certains gaz song plus lourds que l'air et peuvent s'accumuler au niveau du sol.

QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAS :
- Ne pas tenter d'allumer d'appareil.
- Ne touchez à aucun interrupteur ; ne pas vous servir des téléphones se trouvant dans le bâtement.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.

C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main ; ne jamais utiliser d'outil. Si la manette reste coincée, ne pas tenter de la réparer ; appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.

D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Fates inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été plongés dans l'eau.

OPERATING INSTRUCTIONS

1. STOP! Read the safety information to the left on this label.
2. This appliance is equipped with an ignition device, which automatically lights the burner. Do not try to light the burner by hand.
3. Ensure that the gas control valve is turned on.

   Follow "B" in the safety information to the left on this label. If you don't smell gas, go to the next step.
4. Refer to the Owner's Manual for information regarding normal operation of this heating system.
5. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" below on this label and refer to the Owner's Manual troubleshooting section or call the technical support department at 1-800-685-4298.

INSTRUCTIONS DE MISE EN MARCHE

1. ARRÊTEZ! Lisez les instructions de sécurité sur la portion à gauche de cette étiquette.
2. Cet appareil est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. Ne tentez pas d'allumer le brûleur manuellement.
3. Assurez-vous que la soupape de contrôle de gaz est bien ouverte.

   Passez à l'étape B des instructions de sécurité sur la portion à gauche de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
4. Référez au Manuel du propriétaire pour des informations au sujet du fonctionnement normal de ce système de chauffage.
5. Si l'appareil ne fonctionne pas, veuillez suivre les instructions « Pour couper le gaz vers l'appareil » ci-dessous sur cette étiquette et référez à la section Dépannage du Manuel du propriétaire ou appelez le service de soutien technique au 1.800.685.4298.

TO TURN OFF GAS TO APPLIANCE

1. Turn off all electric power to the appliance if service is to be performed.
2. Set all interior thermostats to their lowest setting.
3. Turn the gas control knob located on the heater's propane inlet port clockwise ↷ to the "OFF" position.

COMMENT COUPER L'ADMISSION DE GAZ DE L'APPAREIL

1. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
2. Réglez tous les thermostats intérieurs à leur réglage le plus bas.
3. Tournez le bouton de contrôle du gaz, situé sur le port d'entrée de propane du chauffe-eau, vers la droite ↷ à la position « OFF » (Arrêt).

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Figure 2

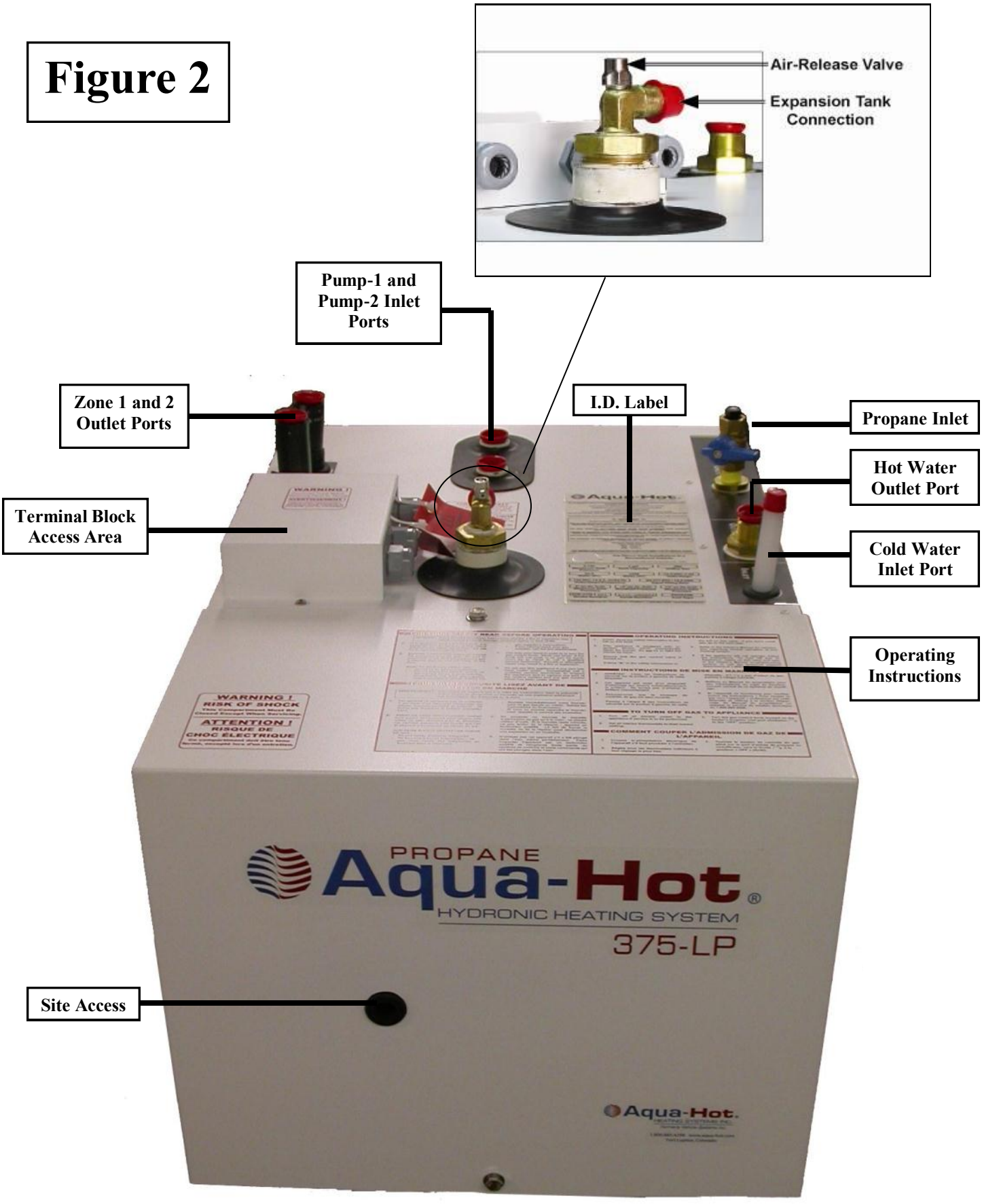

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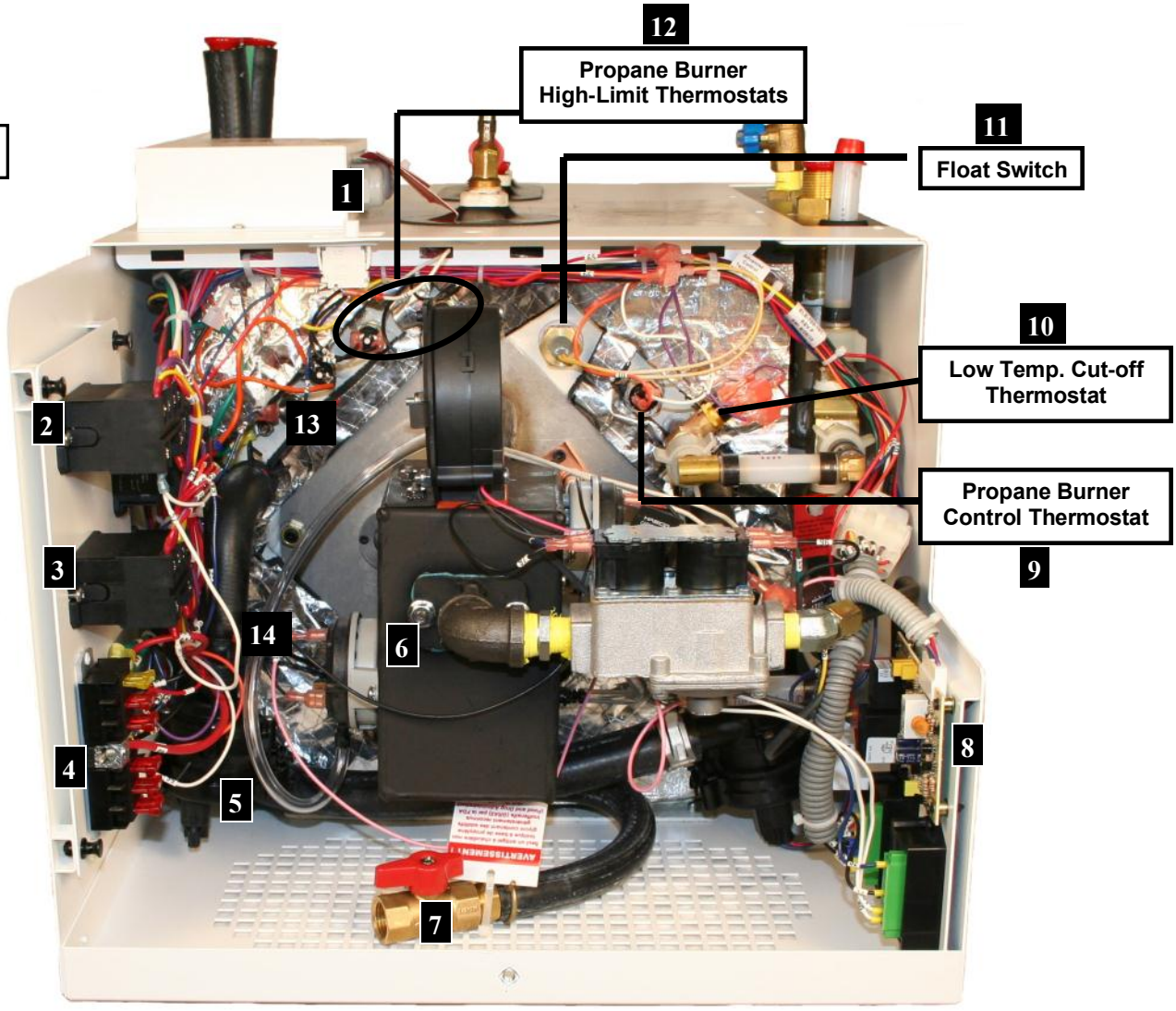
Figure 3



1 INTERLOCK SWITCH
2 ZONE-1 RELAY
3 ZONE-2 RELAY
4 FUSE BLOCK
5 CIRCULATION PUMP - ZONE 1
6 PROPANE-BURNER
7 SYSTEM DRAIN
8 PROPANE-BURNER CONTROLLER
9 PROPANE BURNER CONTROL THERMOSTAT
10 LOW TEMPERATURE CUT-OFF THERMOSTAT
11 FLOAT SWITCH
12 DIESEL-BURNER HIGH-LIMIT THERMOSTATS

13 { Electric Element High-Limit Thermostat
Electric Element Control Thermostat

14 1500 Watt Electric Element

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Figure 4

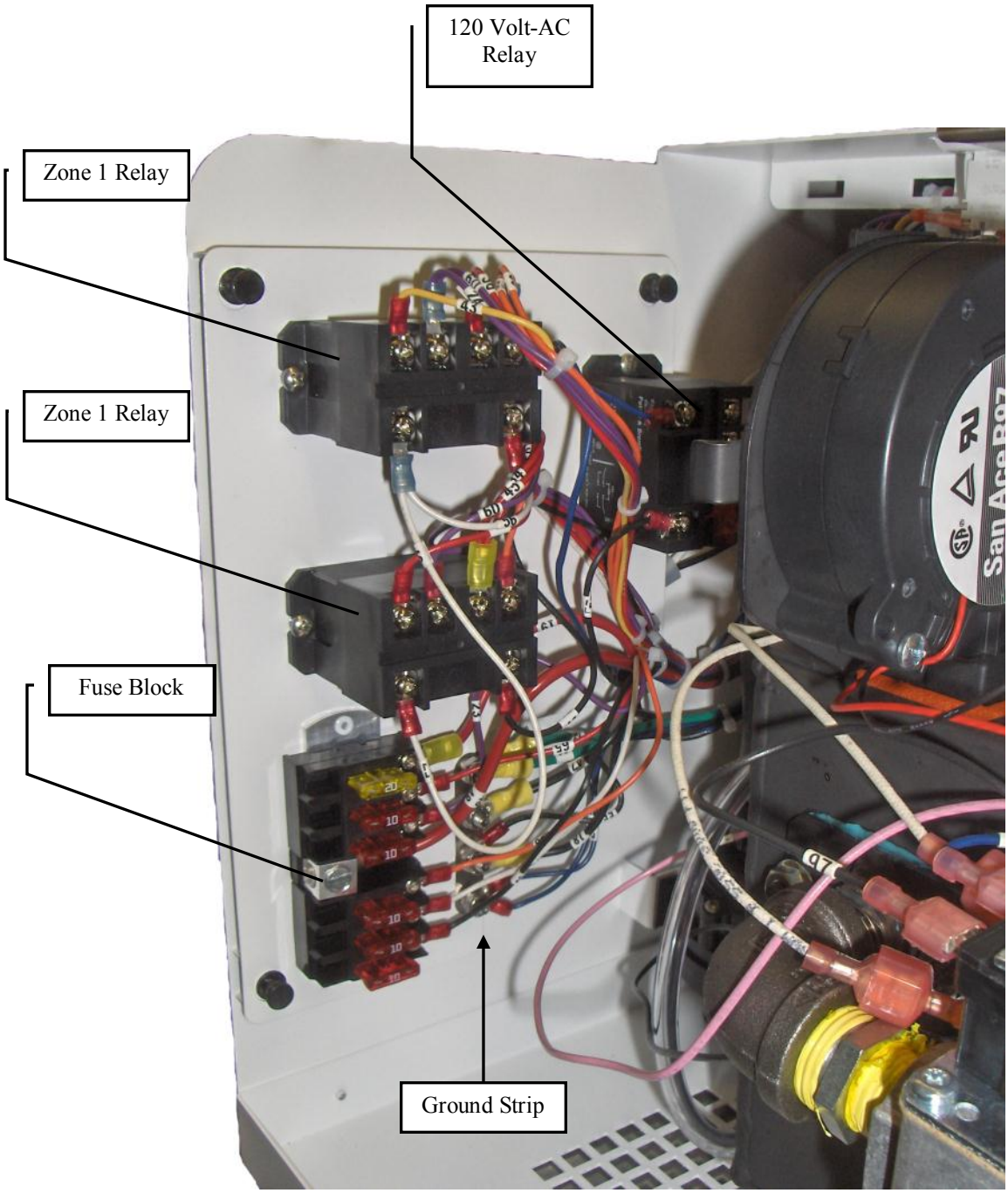

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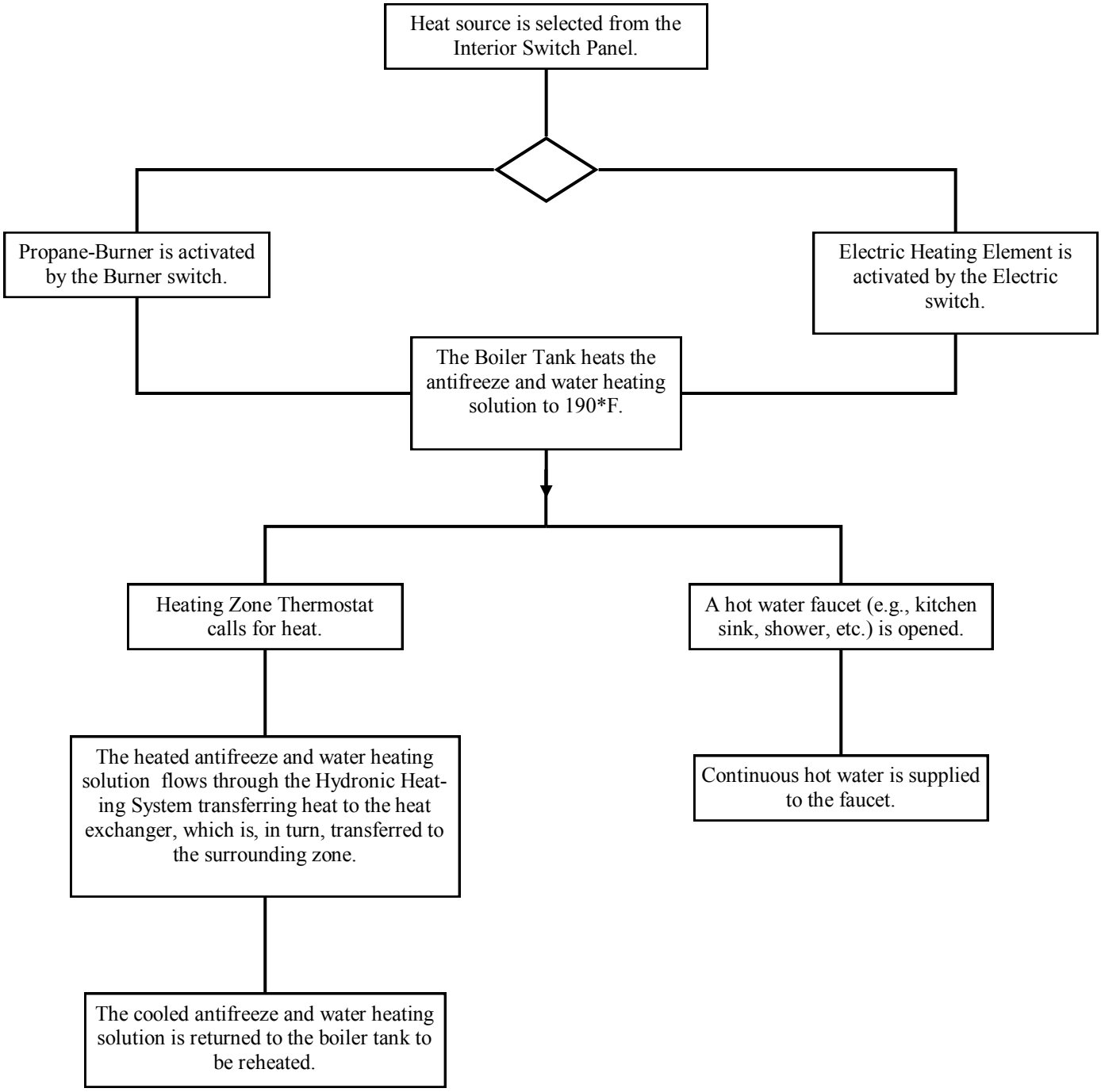
Chart 1

Aqua-Hot Operational Flowchart


Heat source is selected from the Interior Switch Panel.
Propane-Burner is activated by the Burner switch.
Electric Heating Element is activated by the Electric switch.
The Boiler Tank heats the antifreeze and water heating solution to 190*F.
Heating Zone Thermostat calls for heat.
A hot water faucet (e.g., kitchen sink, shower, etc.) is opened.
The heated antifreeze and water heating solution flows through the Hydronic Heating System transferring heat to the heat exchanger, which is, in turn, transferred to the surrounding zone.
Continuous hot water is supplied to the faucet.
The cooled antifreeze and water heating solution is returned to the boiler tank to be reheated.

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Antifreeze and Water Heating Solution:

As the antifreeze type and mixture ratio is essential to the Aqua-Hot's performance and ability to comply with regulations, the following information is being supplied to understand various types of antifreeze, the quality of water necessary, and the mixture ratio. Aqua-Hot Heating Systems Inc. recommends CAMCO's Boiler Antifreeze - 100°.

Antifreeze Types:

The following information addresses the necessary usage of a propylene glycol based "boiler " type antifreeze in the Aqua-Hot. Propylene glycol is a safer alternative to the more toxic ethylene glycol antifreeze; however, as mandated by IAPMO (International Association of Plumbing and Mechanical Officials), only those propylene glycol based "boiler" type antifreezes deemed "Generally Recognized as Safe" (GRAS) by the FDA should be utilized.

Because of the significant impact various types of antifreeze can have on a hydronic heating system, including the level of safety provided, it has been recognized that there is a need to provide an explanation regarding two additional prominent types of antifreeze/coolant available. The following information should be utilized as an educational means of ensuring that the proper type of propylene glycol based antifreeze is selected:

RV & Marine Antifreeze:

These types of propylene glycol based antifreeze products are formulated specifically for "winterizing" applications only. Although RV & Marine antifreeze is often "Generally Recognized as Safe" by the FDA, it should never be used in the Aqua-Hot's Hydronic Heating System Boiler Tank. This type of antifreeze is not formulated to transfer heat, which is essential to the heating system's functionality and does not contain rust inhibitors. Please note, however, that RV & Marine antifreeze can be utilized to winterize the Aqua-Hot's domestic water heating system.

Automotive Antifreeze/Coolant:

These types of propylene glycol based antifreeze products are formulated specifically to protect automotive engines against corrosion, freezing temperatures, and overheating. They also have excellent heat transfer and thermal conductivity characteristics. Although these types of antifreeze products are considered less toxic and safer than ethylene glycol for people, pets, and the environment, they are not "Generally Recognized as Safe" (GRAS) rated by the FDA. Therefore, they must be marked with a "harmful if swallowed" warning. This additional warning is required because these types of antifreeze products contain high levels of chemical inhibitors. Due to their potentially hazardous properties, **they should never be used in the Aqua-Hot's Hydronic Heating System.**

Antifreeze Mixture Water Quality:

In order to ensure maximum performance and longevity of an Aqua-Hot heating system's boiler tank and associated components, it has been determined that there is a need to use distilled, de-ionized, or soft water in combination with concentrated propylene glycol for the Aqua-Hot's antifreeze and water heating solution,. Please note that this is only necessary when mixing concentrated propylene glycol antifreeze with water; suppliers of pre-mixed antifreeze are responsible for the use of high-quality (distilled, de-ionized, or soft) water when preparing their antifreeze for sale.

Hard water possesses a high-level of calcium and magnesium ions, which deplete the propylene glycol antifreeze's corrosion inhibitors. This, in turn, causes the antifreeze and water heating solution to begin turning acidic, which can corrode the Aqua-Hot's boiler tank and associated components prematurely. Therefore, concentrated propylene glycol should be diluted with distilled, de-ionized, or soft water that is 80 ppm or less in total hardness. The local water agency should have up-to-date water quality reports that should indicate if the local tap water is within this guideline.

Antifreeze Terms and Mixture Ratio:

The following information addresses the process of selecting an antifreeze and water mixture ratio that provides adequate freeze, boiling, and rust/anti-corrosive protection. A 50/50 mixture ratio is recommended, which will result in a freeze point of approximately -28°F and a boil point of approximately 222°F.

The following information should be utilized for the purpose of clarifying some terms commonly associated with antifreeze.

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Freeze Point and Burst Point:

Antifreeze lowers the freezing point of any liquid, to which it has been added, by preventing the formation of ice crystals; however, as the ambient temperature continues to decline, the water in the solution will attempt to attain a solid state. The point in which the water begins to solidify is termed the "Freeze Point." Although the water in the solution has begun to freeze, producing a "slushy" consistency, the antifreeze in the solution will continue to combat the normal expansion of the solution as it freezes. The point in which the solution can begin to expand, due to colder temperatures, is called the "burst point." Once the solution reaches the burst point, the potential is present for ruptured pipes to exist. The burst point of the antifreeze and water heating solution is dependent upon the brand of propylene glycol employed.

Boiling Point:

The Aqua-Hot utilizes the antifreeze and water heating solution as a transportation means for the heat produced from the internal processes. The antifreeze absorbs the heat created until its boiling point is reached; it is at this point that the liquid turns to a gas and is expelled to prevent the heating system from overheating. Each time the boiling point is reached, a loss of efficiency occurs because the heat produced is expelled rather than used for the function of the heating system. Therefore, a higher boiling point is desired in order to combat the loss of efficiency, which allows the antifreeze to transport the heat created from the internal process throughout the motor home where it can be used productively rather than dissipating due to its change from a liquid to a gas.

Rust and Anti-Corrosive Inhibitors:

Another major function of antifreeze is to provide protection to the internal metal components of the Aqua-Hot Hydronic heating system from corrosion and rust. Antifreeze is able to perform this function by the addition of rust- and anti-corrosive inhibitors, which are designed specifically to activate in a water solution.

Summary:

Antifreeze has three basic functions: freeze protection, boil-over protection, and anti-corrosion and rust protection.

Antifreeze is also primarily responsible for heat transfer characteristics. Therefore, as water is an excellent heat conductor, it is added to the mixture. A 50/50 solution of propylene glycol antifreeze and water is recommended to provide the best performance combination of the aforementioned functions. If excess propylene glycol exists within an antifreeze and water heating solution, the water's heat absorption properties are compromised, which could ultimately inhibit the Aqua-Hot from providing adequate domestic hot water and interior heating.

Additionally, if the antifreeze and water heating solution contains over 70 percent antifreeze, the freezing point is actually raised, resulting in less freeze protection.

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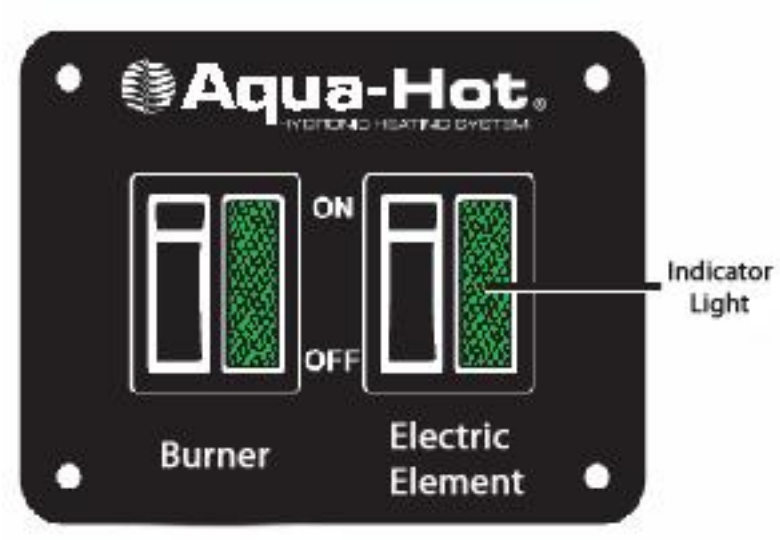
Figure 5



Propane Burner Switch:

The Propane-Burner switch activates the Aqua-Hot's Propane-Burner; reference Figure 5. This procedure allows the Propane-Burner to operate and supply heat to the Aqua-Hot's Boiler Tank, which will heat the Aqua-Hot's antifreeze and water heating solution to the maximum operating temperature of 190±5°F in approximately **10-20 minutes**.

The indicator light, adjacent to the Propane-Burner switch, will illuminate whenever the Propane-Burner switch is in the **ON** position.

Please note that the Propane-Burner is the Aqua-Hot's **primary heat source** for heating both the interior and/or the domestic hot water (such as when cool ambient temperatures exist and/or when there is a high demand for domestic hot water).

Electric Element Switch:

NOTE: This feature is only operational whenever the Motor home is connected to 120 Volt-AC power or when the generator is operating.

The Electric Element switch activates the Aqua-Hot's 120 Volt-AC Electric Heating Element; reference Figure 5. This procedure allows the 120 Volt-AC Electric Heating Element to operate and supply heat to the Aqua-Hot's Boiler Tank, which will heat the Aqua-Hot's antifreeze and water heating solution to the maximum operating temperature of 190±5°F in approximately **1-2 hours.**

The indicator light, adjacent to the Electric Element switch, will illuminate whenever the Electric Element switch is in the **ON** position.

Please note that the 120 Volt-AC Electric Heating Element is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water).

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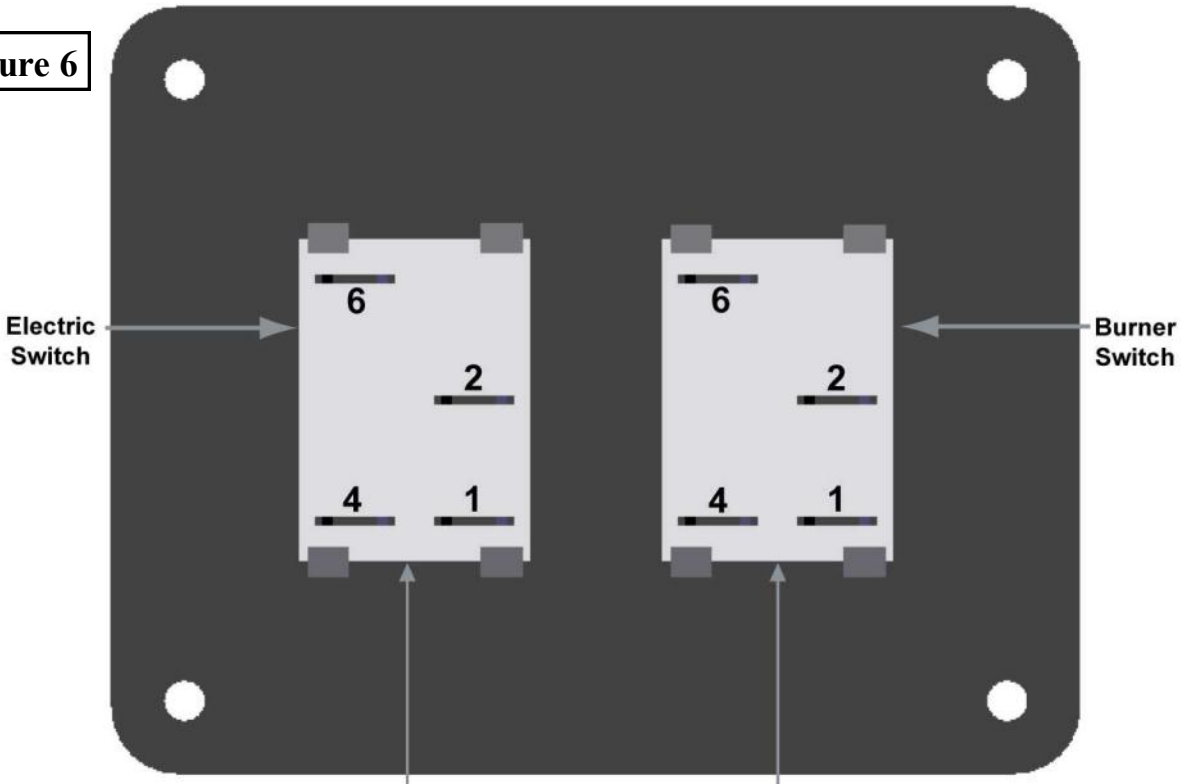
Figure 6



SWITCH	MOUNT LOCATION
Pin 1	Terminal Block A0
Pin 2	Terminal Block A1
Pin 4	Jump to Pin 1
Pin 6	Chassis Ground

SWITCH	MOUNT LOCATION
Pin 1	Terminal Block D0
Pin 2	Terminal Block D1
Pin 4	Terminal Block L+
Pin 6	Terminal Block L-

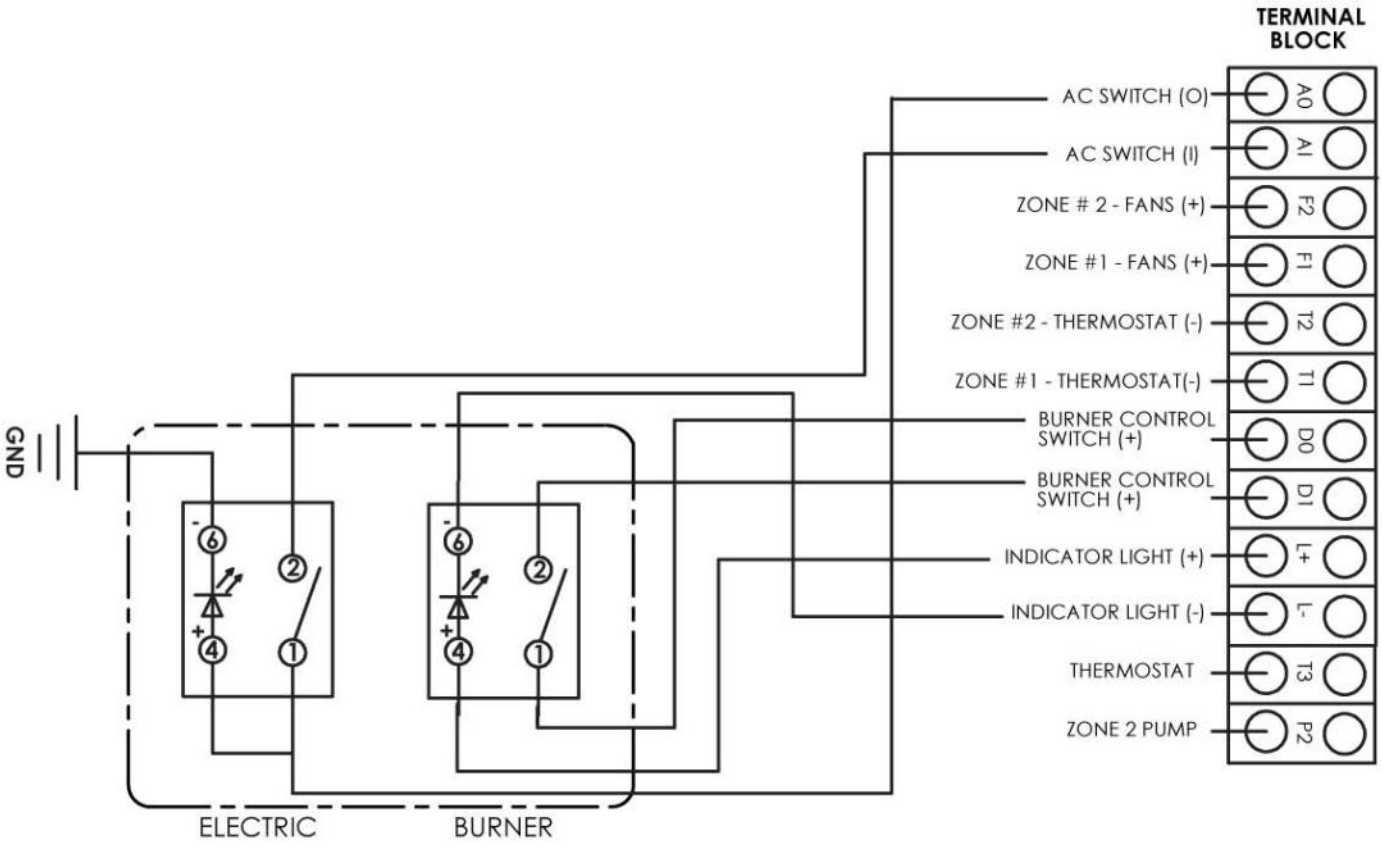


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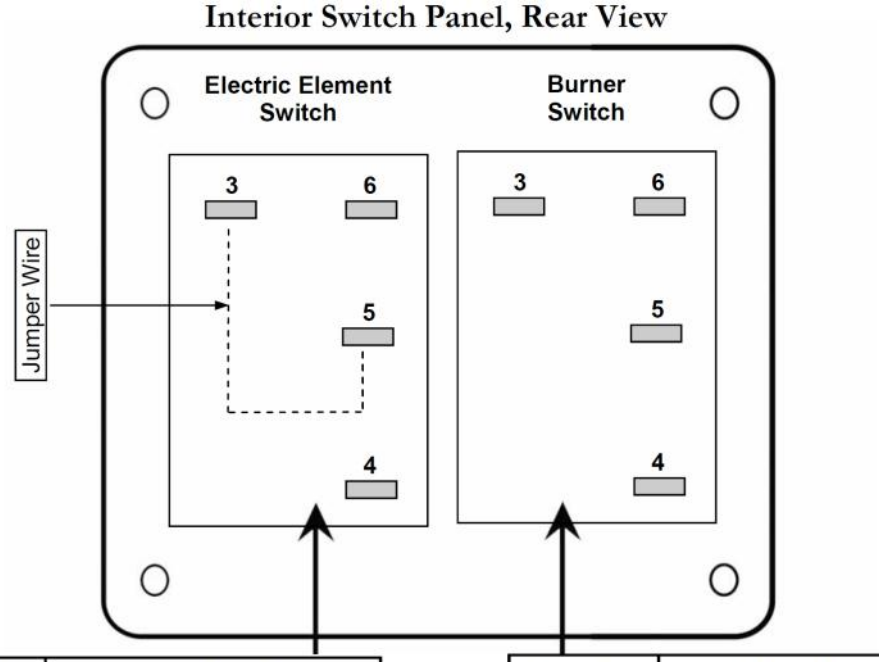
Figure ?

Interior Switch Panel, Rear View



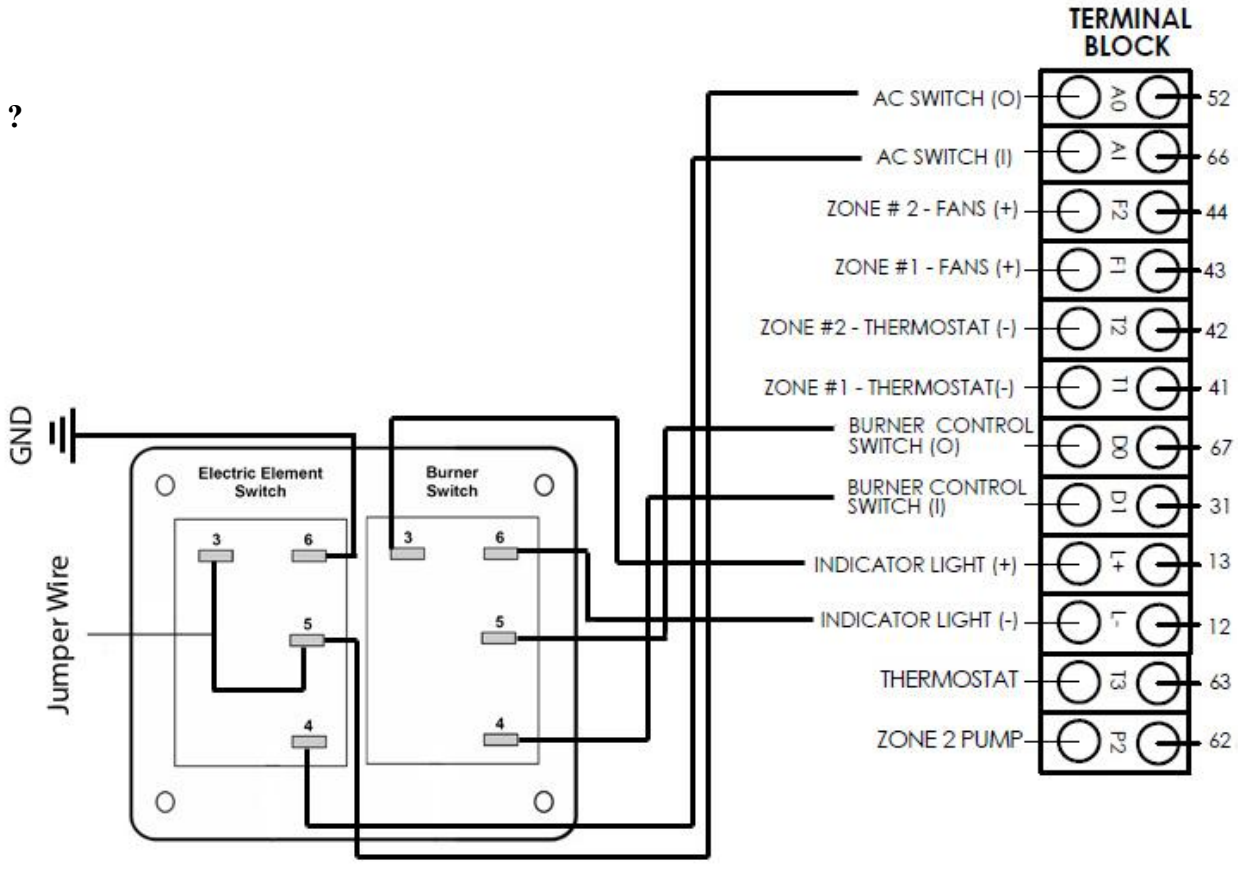
Switch	Mount Location
Pin# 5	Terminal Block AO
Pin# 4	Terminal Block A1
Pin# 3	Jump to Pin # 5
Pin# 6	Chassis Ground

Electric Element Switch to Terminal Block connections

Switch	Mount Location
Pin# 5	Terminal Block DO
Pin# 4	Terminal Block D1
Pin# 3	Terminal Block L+
Pin# 6	Terminal Block L-

Burner Switch to Terminal Block connections

Figure ?



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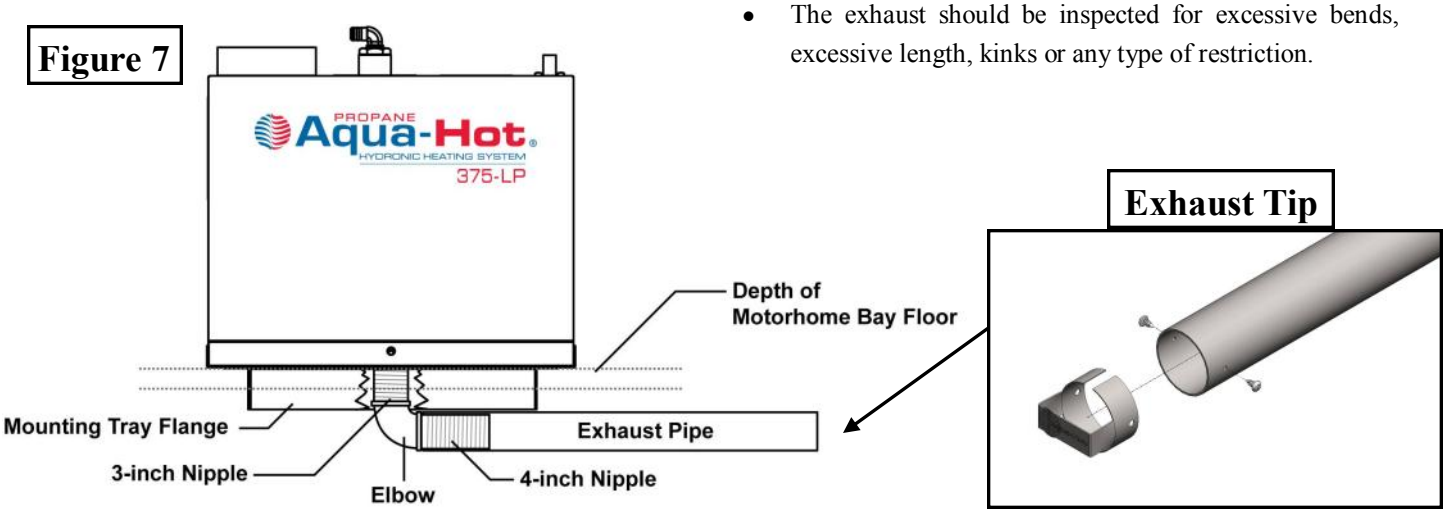
Because the Aqua-Hot's exhaust is hot and must be kept away from any heat-sensitive material, the exhaust system should be checked to ensure that it continues to meet the following requirements:

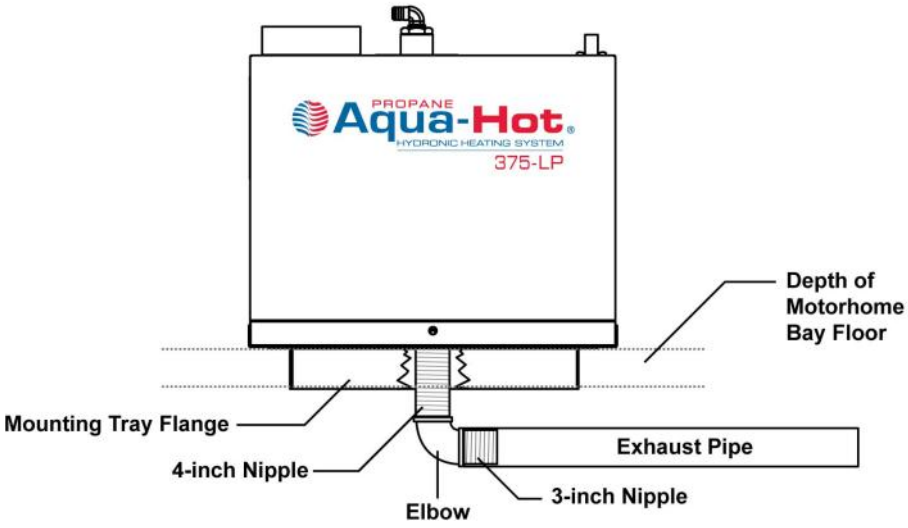
- The exhaust must not be directed downward as a fire could result when parked in dry, grassy areas.
- The exhaust must not terminate underneath the vehicle, underneath an openable window or vent, in the awning area of the motor home (if applicable), or near slide-out areas.
- A maximum of one 90° and one 45° exhaust pipe bends are allowed.
- The total length of the exhaust pipe shall not exceed 11'.
- The exhaust must be able to freely exit away from the vehicle without any obstructions.
- Two-inch standard automotive-type exhaust piping should be used with a maximum of two 90-degree pipe bends and should not exceed 11 feet.
- The Exhaust Tip must be used to deflect wind gusts

NOTE: The Exhaust Tip has a required clearance of one inch between the band on the exhaust tip and the end of the exhaust pipe. Improper installation of the exhaust tip may result in the propane burner "short cycling" due to back pressure.

- The 3-inch and 4-inch black-pipe nipples and the exhaust elbow - originally supplied with the Aqua-Hot, must be present.
- The exhaust should be inspected for excessive bends, excessive length, kinks or any type of restriction.

Figure 7





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This section details various components of the Aqua-Hot that may require troubleshooting and/or replacement in the event of a malfunction. The Propane-burner and its components are detailed in Section 8 of this manual.

Replacement parts can be ordered through Aqua-Hot's Web site at www.aquahot.com or by calling 1-800-685-4298.

If additional assistance is needed, the Technical Support Team can also be reached, Monday through Friday, from 7:00 AM to 4:00 PM Mountain Standard Time at 1-800-685-4298.

Sensors/Switches

Interlock Switch:

The interlock switch is a safety device designed to ensure that the Aqua-Hot's access cover is securely installed before allowing the Propane-Burner to operate. For location of interlock switch reference Figure 3.

Note: If the cover is removed or the interlock switch is defective the Propane-burner switch indicator light will not illuminate.

Troubleshoot the interlock switch if the following condition has occurred:

- **The Propane-Burner fails to operate.**
- **The light on the Burner Switch fails to illuminate.**

Troubleshooting:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during testing for the switch's functionality.

1. Turn the Propane-Burner switch on, from the interior switch panel and ensure that the boiler tank has sufficiently cooled in order to require heat from the Propane-burner.

2. Disconnect the yellow and white wires from the interlock switch noting that wire #31 is connected to the terminal labeled "NO" and wire #9 is connected to the terminal labeled "COM."

3. Using an ohmmeter, check the interlock switch for continuity while the button is pushed in.

If continuity is not present with the button pushed in, follow the instructions in this section to replace the interlock switch.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Disconnect the interlock switch's wires by pulling the quick connectors from the switch's spade terminals.

2. Release the interlock switch from the Aqua-Hot cabinet by pushing in on the locking tabs and pulling the interlock switch.

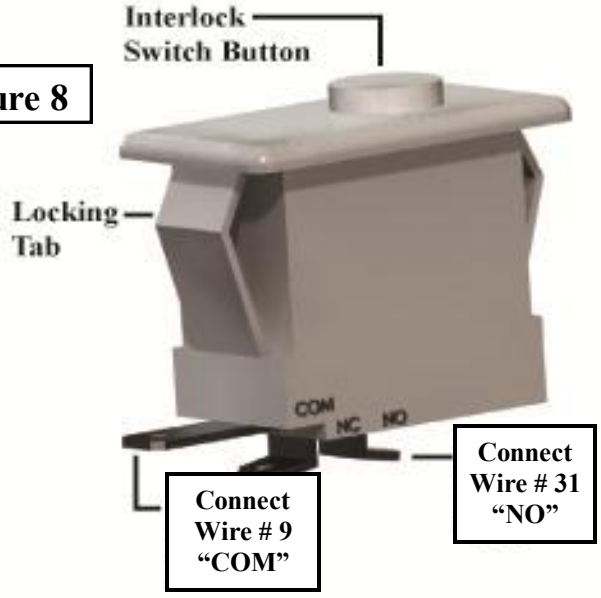
3. Remove the defective interlock switch from the Aqua-Hot.

4. Install the replacement interlock switch onto the Aqua-Hot ensuring that the locking tabs snap into place.

5. Connect the Aqua-Hot's wires to the replacement interlock switch with yellow wire #31 connected to the terminal labeled "NO" and yellow wire #9 connected to the terminal labeled "COM."

NOTE: If the interlock switch's wires are reversed, the interlock switch will only allow the Propane-Burner to operate when the access cover is removed and the button on the switch is released.

Figure 8



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Float Switch:

The Float Switch monitors the level of antifreeze and water heating solution within the Aqua-Hot's boiler tank to ensure that an adequate volume exists. Reference Figure 9 for location.

Troubleshoot the Float Switch if one of the following conditions has occurred:

- The Propane-Burner and/or Electric Heating element fail to operate.
- The Propane Burner and/or Electric Heating Element Switches Fail to illuminate.

Troubleshooting:

1. Verify that the Aqua-Hot's boiler tank is full of the antifreeze and water heating solution.

2. Verify that the connections for the wires on the float switch are securely plugged into the wiring harness.

3. Verify Fuse "B", on the Fuse Block is sending power to the float switch.

4. Inspect the wire harness for damaged or severed wires. If no wires are found to be damaged or severed, continue.

5. Verify the functionality of the Float Switch by completing the following:

   A. Disconnect the wires from the Float Switch.

   B. Install a jumper wire between the wires on the harness, #65 & #66, in order to bypass the Float Switch.

   If the Propane-Burner and/or electric heating element come on when the jumper wire is installed, follow the instructions in this section to replace the float switch

NOTE: The Float Switch can be tested by performing a Continuity Test. With the heater full of antifreeze there should be continuity between the wires on the Float Switch.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.

2. Drain the antifreeze and water heating solution from the Aqua-Hot's boiler tank using the drain valve, Approximately 2 gallons will need to be drained..

3. Disconnect the float switch's wires by separating the quick-disconnect terminals.

4. Using a 7/8 socket, remove the defective float switch from the Aqua-Hot's boiler tank.

5. Wrap the threads of the replacement float switch with a thread seal tape.

6. Screw the replacement float switch into the port on the Aqua-Hot's boiler tank and tighten securely with a 7/8 socket, ensuring the N.O. stamp in on top.

7. Connect the replacement float switch's wires in the same configuration as the removed float switch's wires.

8. Refill the Aqua-Hot's Boiler tank with the proper water/antifreeze mixture. Reference Section 5 in this manual for instructions on filling and draining the Aqua-Hot unit.

9. Test for proper operation.

⚠ DANGER! ⚠

Be sure to install the replacement float switch with the "N.O." stamp on top, failure to do so, will allow the diesel/electric to come on with no antifreeze in the boiler tank.

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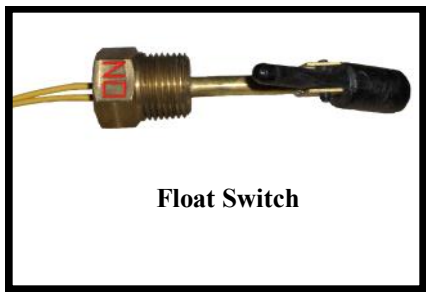
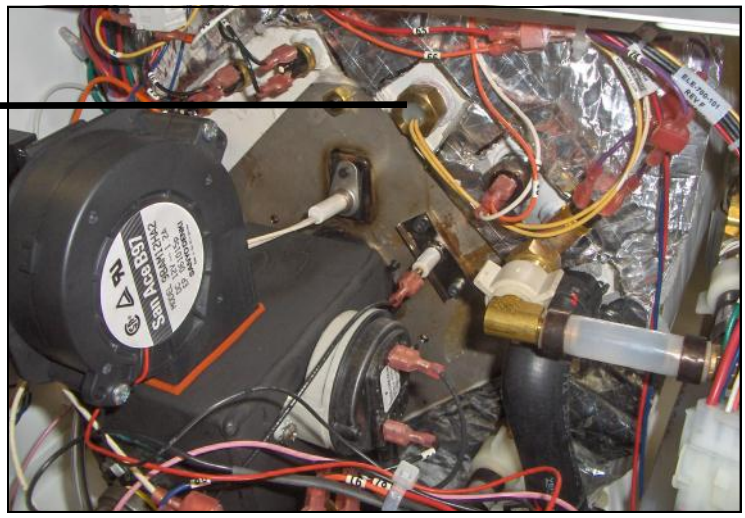
Figure 9



Float Switch



Thermostats

Control Thermostat: Propane-Burner

The Propane Burner's control thermostat is installed into the Aqua-Hot's boiler tank and monitors the temperature of the antifreeze and water heating solution to determine when it is at operating temperature and when it requires heat. The Aqua-Hot is considered to be at operating temperature between 158°F and 190°F. Reference Figure 10 for the location of the Control Thermostat..

Troubleshoot the control thermostat if one of the following conditions has occurred:

- The Propane-Burner Fails To operate.
- There is a lack of hot domestic water and interior heat.

Troubleshooting:

1. Turn the Propane-Burner switch on from the interior switch panel and ensure that the boiler tank has sufficiently cooled in order to require heat from the diesel-burner.

If the burner does not come on and run, check the following:

A. Verify that the temperature of the boiler tank has fallen below the 158°F minimum operating temperature by checking with a digital thermometer.

B. Disconnect the control thermostat's wires from their connections, and, using an ohmmeter, check for continuity.

If there is no continuity, follow the instructions in this section for replacing the control thermostat.

If continuity exists, complete the following:

1. Inspect the control thermostat's wiring and connections for any signs of damage or corrosion.

C. If the Propane-Burner does come and run, but there is still a lack of domestic hot water/interior coach heat:

1. Check operational temperature of the control thermostat by using a digital thermometer. If the temperature range of the control thermostat is not within specifications, replace the control thermostat.

Note: The operational range of the Propane-Burner 's control thermostat is 158° F - 190° F.

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Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.

2. Drain 2 gallons of the antifreeze and water heating solution from the Aqua-Hot boiler tank using the drain valve.

3. Disconnect the defective control thermostat's wires by separating the quick-disconnect terminals. Reference Figure 10 for location.

4. Using a 7/8 socket, unscrew the control thermostat from the Aqua-Hot's boiler tank.

5. Wrap the threads of the replacement control thermostat with a thread seal tape.

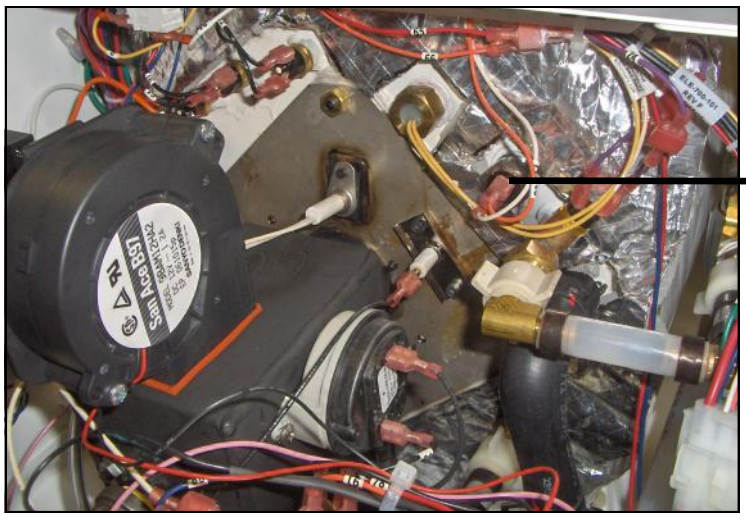
6. Screw the replacement control thermostat into the port on the Aqua-Hot boiler tank and tighten securely with a 7/8 socket.

7. Reconnect control thermostat wires.

8. Refill the Aqua-Hot boiler tank with the antifreeze and water heating solution.

9. Test the Aqua-Hot for normal operation using a digital thermometer.

Figure 10



185 °F Propane Burner Control Thermostat

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Thermostats (continued)

Control Thermostat: Electric Element

The control thermostat for the 120 VAC Electric Heating Element is installed on the Aqua-Hot's boiler tank and monitors the temperature of the antifreeze and water heating solution to determine when it is at operating temperature and when it requires heat. The Aqua-Hot is considered to be at operating temperature between 158°F and 190°F.

Troubleshoot the electric element control thermostat if one of the following conditions has occurred:

- The Electric Element Fails To operate.
- There is a lack of hot domestic water and interior heat.

NOTE: For continuous domestic hot water to be present, the Propane-Burner must also be selected as a heating source.

Troubleshooting:

1. Turn the electric element switch on from the interior switch panel and ensure that the boiler tank has sufficiently cooled in order to require heat from the electric-element.

2. Using a Digital Clamp-on Amp meter, place it around the Black wire, #51, coming off of the electric element. Set the Clamp-on Amp meter to register AC amps. The 1500 Watt electric element should pull 11.5 - 12.5amps.

NOTE: The coach must either be plugged into shore power, or the generator must be on, for there to be 120vac at the heater.

If the Electric Element is not within spec check the following:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

A. Verify that the temperature of the boiler tank has fallen below the 158°F minimum operating temperature by checking with a digital thermometer.

B. Disconnect the control thermostat's wires, #52 & #54, from their connections, and, using an ohmmeter, check for continuity on the control thermostat.

If there is no continuity, follow the instructions in this section for replacing the control thermostat.

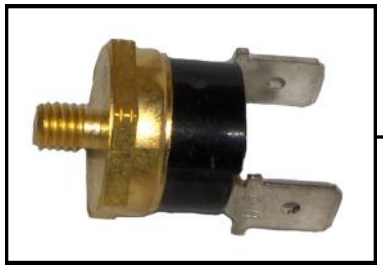
3. If the Electric Element does come and run, but there is still a lack of domestic hot water/interior coach heat:

   1. Check operational temperature of the control thermostat by using a digital thermometer.

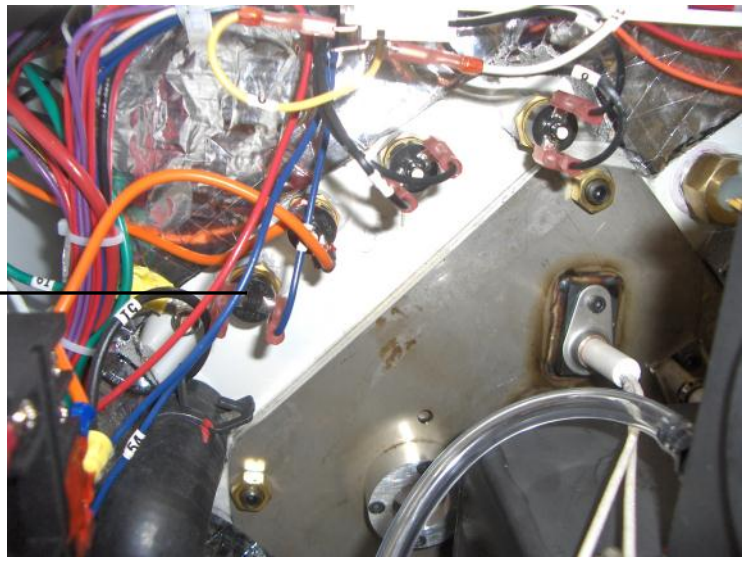
      If the temperature range of the control thermostat is not within specifications, replace the control thermostat.

Note: The operational range of the Electric Element control thermostat is 158° F - 190° F.

Figure 11



185° F
Control Thermostat



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Thermostats (continued)

Control Thermostat: Electric Element (continued)

Replacement Procedure:

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected.

2. Locate the control thermostat for the electric element. Reference Figure 12.

3. Disconnect the defective control thermostat's wires by separating the quick-disconnect terminals.

4. Using a 5/8 wrench or socket, remove the defective control thermostat from the Aqua-Hot.

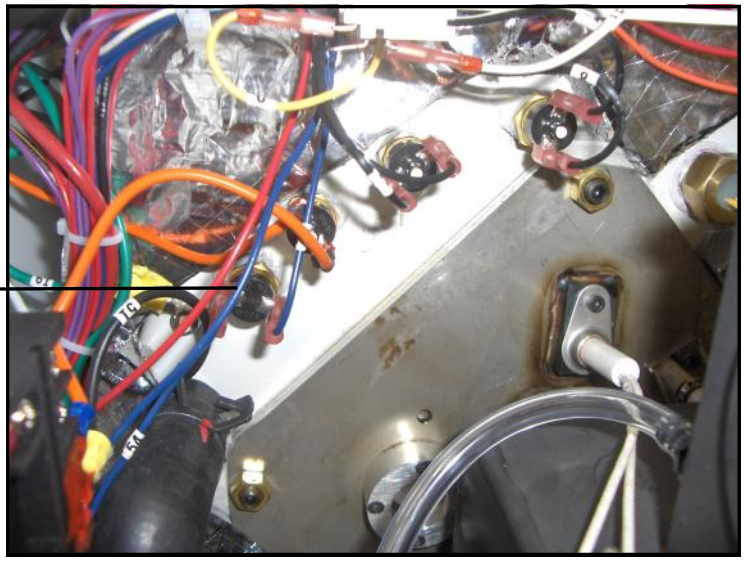
5. Install the replacement control thermostat, tightening only to 15 in/lbs. **Do not over-tighten.**

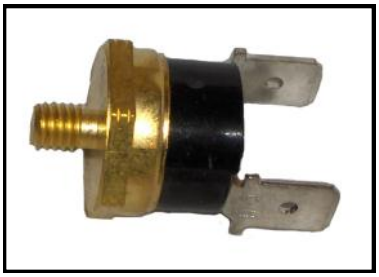
6. Connect the replacement control thermostat's wires in the same configuration as the removed thermostat's wires.

7. Test for proper operation, by using a digital thermometer.

NOTE: The coach must either be plugged into shore power, or the generator must be on, for there to be 120 VAC at the heater.

Figure 12





185° F Control Thermostat

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AC High-Limit Thermostat:

The AC high-limit thermostat serves as a safety measure in the event that the electric heating element continues to operate after the maximum operating temperature is reached. The high-limit thermostat allows the current for the heating element to pass through it until the boiler tank reaches a temperature of 215°F. Should this temperature be reached, the high-limit thermostat blocks the current to the element, which prevents it from continuing to provide heat to the boiler tank.

Troubleshoot the AC high-limit thermostat if the following condition has occurred:

- The electric heating element fails to operate.

Troubleshooting:

1. Disconnect all power supplies.
2. Verify that the boiler tank's temperature is below 215°F.
3. Locate the AC high-limit thermostat and remove its wires. Reference Figure 13 for location
4. Using a digital volt meter, set to check continuity, check the thermostat for continuity.

   If there is no continuity, press the white reset button on the thermostat and re-check for continuity.

   If continuity is still not present after the reset button has been pressed, follow the instructions in this section to replace the AC high-limit thermostat.

NOTE: If the high limit thermostat is tripped, it is recommended to test both the A.C. and D.C. control thermostats for proper operation.

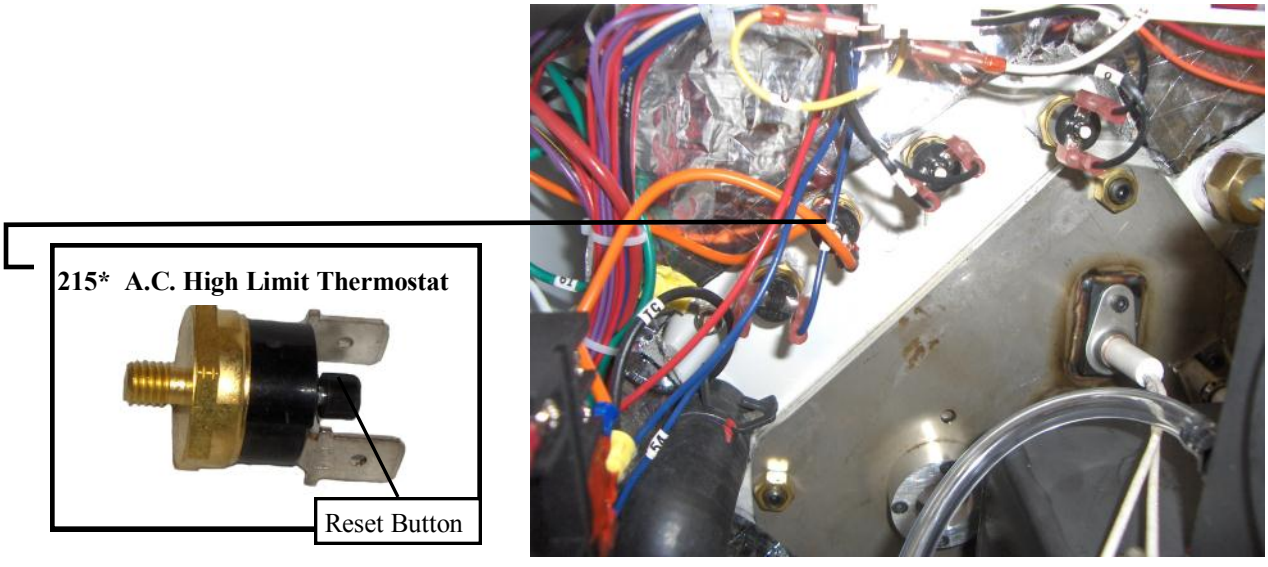
Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power supplies have been disconnected.
2. If applicable, remove the heat shrink insulation covering the wires and terminals on the defective high-limit thermostat.
3. Remove the two wires from the defective high-limit thermostat by pulling firmly on the wires.
4. Using a 5/8 wrench or socket, remove the defective high -limit thermostat from the Aqua-Hot's boiler tank.
5. Install the replacement high-limit thermostat into the port on the Aqua-Hot's boiler tank and finger-tighten only (15 in/lbs). **Do Not Over-Tighten.**
6. Connect the wires removed from the defective high-limit thermostat to the replacement high-limit thermostat.
7. Test for normal operation.

Figure 13



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DC High-Limit Thermostat: Left

The left DC high-limit thermostats serve as a safety measure in the event that the Propane-Burner continues to operate after the maximum operating temperature is reached. The high-limit thermostats allow the current for the Propane-Burner to pass through them until the boiler tank reaches a temperature of 215°F. Should this temperature be reached, the left high-limit thermostat will trip, which will prevent the Propane-Burner from operating.

Troubleshoot the Left DC high-limit thermostat if the following condition has occurred:

- The Propane-Burner fails to operate.

Troubleshooting:

1. Disconnect all power supplies.
2. Verify that the boiler tank's temperature is below 215°F.
3. Locate the Left DC high-limit thermostat and remove its wires. Reference Figure 14 for location
4. Using a digital volt meter, set to check continuity, check the thermostat for continuity.

   If there is no continuity, press the white reset button on the thermostat and re-check for continuity.

   If continuity is still not present after the reset button has been pressed, follow the instructions in this section to replace the Left DC high-limit thermostat.

NOTE: If the high limit thermostat is tripped, it is recommended to test both the A.C. and D.C. control thermostats for proper operation.

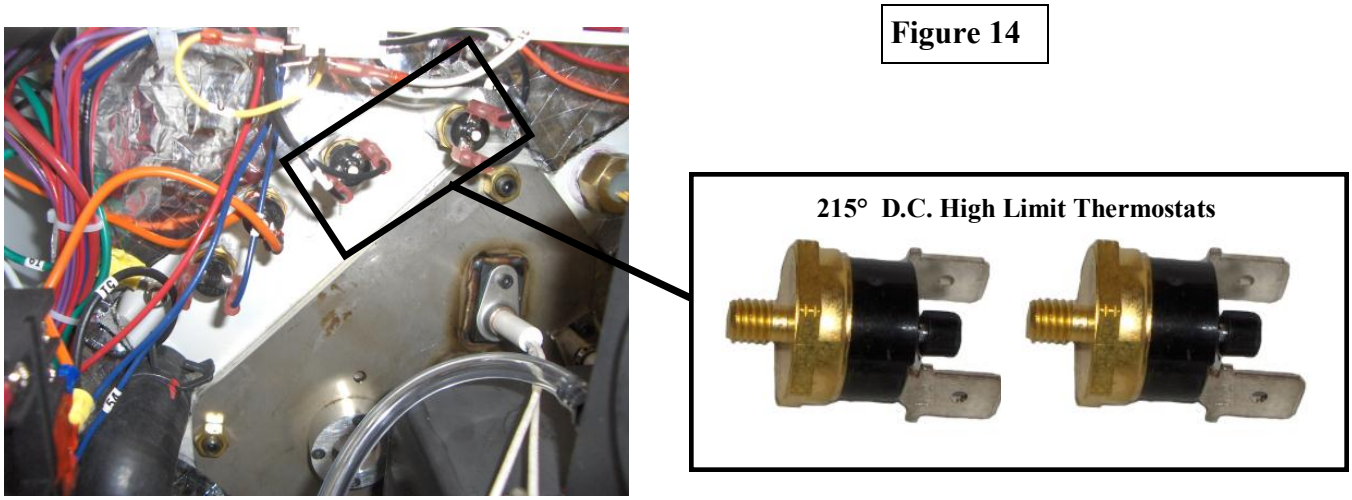
Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected.
2. Remove the two wires from the defective high-limit thermostat by pulling firmly on the wires.
3. Using a 5/8 wrench or socket, remove the defective high-limit thermostat from the Aqua-Hot's boiler tank.
4. Install the replacement high-limit thermostat into the port on the Aqua-Hot's boiler tank and finger-tighten only (15 in/lbs). **Do Not Over-Tighten**
5. Connect the wires removed from the defective high-limit thermostat to the replacement high-limit thermostat.
6. Test for proper operation.

Figure 14



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DC High-Limit Thermostat: Right

The DC high-limit thermostats serve as a safety measure in the event that the Propane-Burner continues to operate after the maximum operating temperature is reached. The high-limit thermostats allow the current for the Propane-Burner to pass through them until the boiler tank reaches a temperature of 215°F. Should this temperature be reached, the right high-limit thermostat tells the control board that the fan has stopped and it goes into a shutdown sequence and possible lockdown for an hour.

Troubleshoot the right DC high-limit thermostat if the following condition has occurred:

- Propane-Burner fails to operate.
- If the Combustion Blower Fan fails to operate.

Troubleshooting:

1. Disconnect all power supplies.
2. Verify that the boiler tank's temperature is below 215°F.
3. Locate the Right DC high-limit thermostat and remove its wires. Reference Figure 15 for location
4. Using a digital volt meter, set to check continuity, check the thermostat for continuity.

   If there is no continuity, press the white reset button on the thermostat and re-check for continuity.

   If continuity is still not present after the reset button has been pressed, follow the instructions in this section to replace the Right DC high-limit thermostat.

NOTE: If the high limit thermostat is tripped, it is recommended to test both the A.C. and D.C. control thermostats for proper operation.

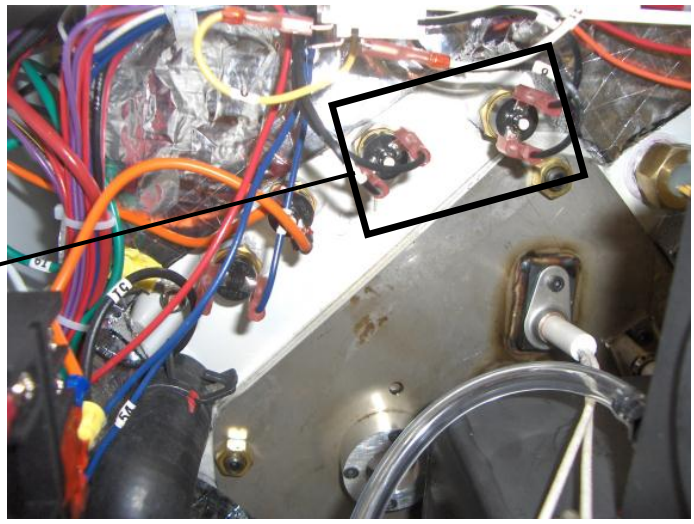
Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected.
2. Remove the two wires from the defective high-limit thermostat by pulling firmly on the wires.
3. Using a 5/8 wrench or socket, remove the defective high-limit thermostat from the Aqua-Hot's boiler tank.
4. Install the replacement high-limit thermostat into the port on the Aqua-Hot's boiler tank and finger-tighten only (15 in/lbs).
5. Connect the wires removed from the defective high-limit thermostat to the replacement high-limit thermostat.
6. Test for proper operation.

Figure 15



215° D.C. High Limit Thermostats

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Low-Temperature Cut-off Thermostat:

The low-temperature cut-off thermostat operates the domestic water priority system by blocking the interior heating feature when domestic hot water is being used. This ensures that even heat is provided for domestic hot water, which avoids the possibility of cold water pockets during showers.

NOTE: The Low Temperature Cut-Off thermostat disables on the interior heating zone fans, only.

Troubleshoot the low-temperature cut-off thermostat if the following conditions have occurred:

- There is a lack of interior heat.
- There is a lack of hot water .

Troubleshooting:

Lack of Interior Heat

1. Determine if the conditions are right for the "Low Temp Cut-off Thermostat to be reset

A. Verify that the Aqua-Hot is at operating temperature - between 158°F and 190°F.

B. Verify that the domestic hot water is not being used.

If the "Low Temp Cutoff " thermostat is not reset (i.e. has continuity) after it has been determined that it should be reset, complete the following:

A. Using a temperature sensor, verify that the low-temperature cutoff thermostat is above 100°F.

If the thermostat is below 90°F, verify that the Aqua -Hot is up to operating temperature and that a hot water faucet is not leaking.

B. Disconnect the low-temperature cut-off thermostat's wires from the Aqua-Hot's wiring harness, then, jump the wiring harness wires for the thermostat together to bypass the thermostat. Wires 23 &24.

If the Heater works properly with the thermostat bypassed, follow the instructions in this section to replace the low-temperature cutoff thermostat.

Lack of Hot Water

1. If the "Low Temp Cutoff Thermostat" Does not trip when domestic hot water is being used or when the Aqua-Hot falls below operating temperature, complete the following:

A. Using a temperature sensor, verify that the low-temperature cutoff thermostat is below 90°F, which is necessary for the thermostat to trip.

B. Inspect the wiring to ensure that the Aqua-Hot is wired properly and that the low-temperature cutoff thermostat has not been bypassed via jumper wires.

C. Ensure the Domestic water lines have been plumbed properly into and out of the heater.

2. Disconnect the Low Temperature Cut-Off thermostat's wires from the Aqua-Hot's wiring harness, and test for proper operation.

A. If the Heater makes good hot water with the Low Temperature Cut-Off Thermostat disconnected, replace the Low Temperature Cut off Thermostat.

NOTE: It is recommended to test the cold water coming into the heater, before replacing the Low Temperature Cut-Off thermostat. Warm fresh water being supplied to the heater will result in the Low Temperature Cut-off thermostat not tripping.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected.

2. Locate the low-temperature cut-off thermostat on the cold domestic water inlet pipe on the Aqua-Hot.

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3. Disconnect the defective low-temperature cut-off thermostat's wires by separating the quick-disconnect terminals.

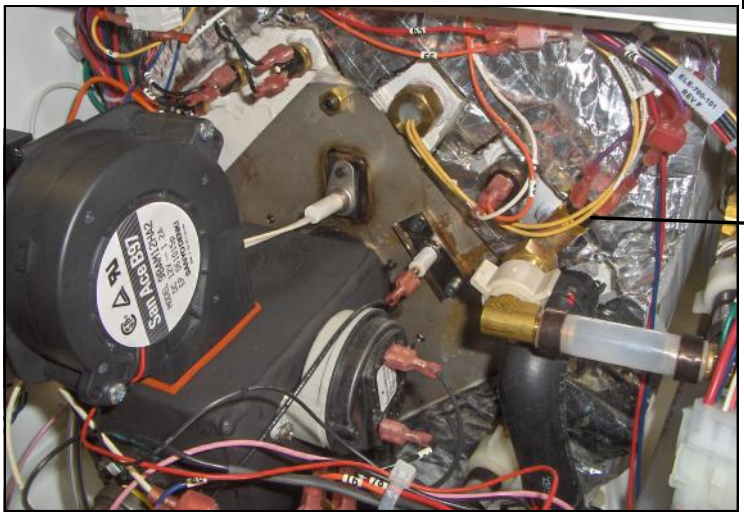
4. Using a 5/8 wrench or socket, remove the defective low-temperature cut-off thermostat from the Aqua-Hot.

5. Install the replacement low-temperature cut-off thermostat tightening only to 15 in/lbs. **Do not overtighten.**

6. Connect the replacement low-temperature cut-off thermostat's wires in the same configuration as the removed thermostat's wires.

7. Test for proper operation.

Figure 16



Low Temperature Cutoff Thermostat

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Valves

Interior Zone Check Valve:

Check valves are installed into the zone outlet ports for each heating loop to ensure that the antifreeze and water heating solution only flows in one direction. If the heating solution attempts to backflow into the boiler tank, the check valve closes to prevent that from happening.

Troubleshoot the check valves if the following condition has occurred:

- The zone pump and fans are operating, but there is still a lack of interior heat in a particular zone.

Troubleshooting:

1. Verify that the heating zone is operating properly by checking the following:

   A. Check the Room Thermostat, to ensure it is calling for heat.

   B. Check the circulation pump for operation by visually inspecting it for rotation of the pump.

2. With the circulation pump operating, tap on the check valve and wait five minutes to evaluate if interior heat is now present.

   If interior heat is present after tapping on the check valve, the check valve was stuck closed .

3. Check the Aqua-Hot's antifreeze and water heating solution's ratio of water to propylene glycol. The mixture ratio should be approximately 50/50. If the solution is comprised fully of antifreeze (100%), the check valves will continue to stick.

NOTE: Storing the motor home for an extended period of time can cause the check valves to stick. If, after the initial release of the stuck check valve, it continues to stick, or if it never releases follow the instructions in this section to replace the check valve.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.

2. Drain the antifreeze and water heating solution from the Aqua-Hot's boiler tank using the drain valve.

3. Remove the Check Valve Access cover, on the side of the Aqua-Hot.

4. Using constant tension pliers, loosen and slide back the constant tension clamps securing the hoses to the defective check valve.

5. Remove the hoses from the defective check valve.

6. Remove both the 90* hose barb and the straight hose barb fittings from the defective check valve.

7. Clean the 90* hose barb and straight hose barb fittings, then wrap the 90* hose barb and the straight hose barb threads with a thread seal tape.

8. Install the 90* hose barb and straight hose barb fittings on the replacement check valve, ensuring that they are installed properly with the 90* hose barb on the arrow side of the check valve. Reference Figure 17.

9. Install the replacement check valve onto the Aqua-Hot's boiler tank. The arrow on the check valve must point towards the back of the boiler tank.

10. Slide the hoses back onto the replacement check valve and set the constant tension clamp back into place.

11. Refill the Aqua-Hot's boiler tank with the antifreeze and water heating solution. Reference Section 5.

12. Test for proper operation.

13. Reinstall the Check Valve Access Cover.

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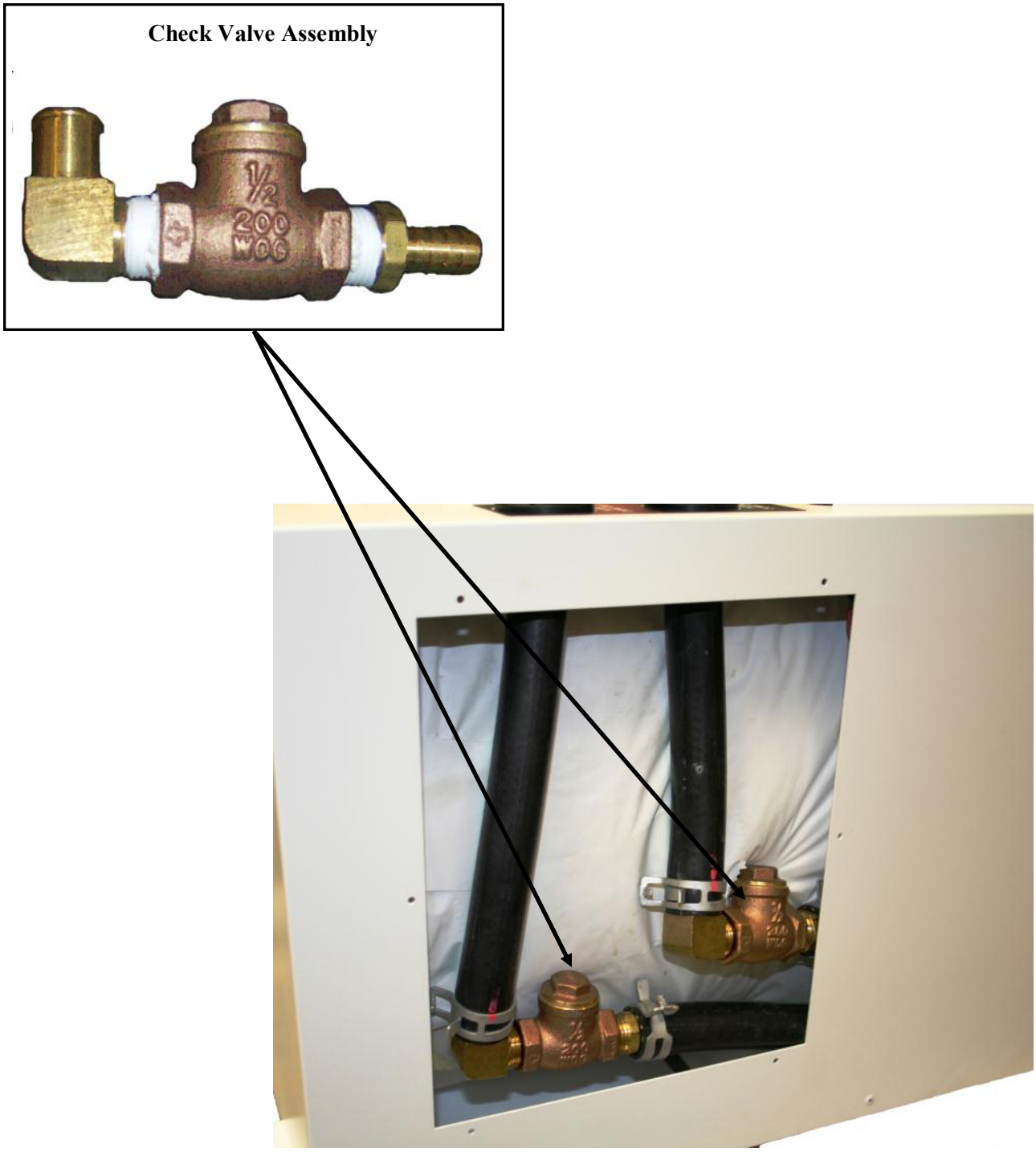
Figure 17



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Tempering Valve:

The tempering valve for the Aqua-Hot mixes the heated domestic water from the boiler tank with cold domestic water at a preset ratio to reduce the risk of scalding.

Troubleshoot the tempering valve if the following condition has occurred:

- There is a lack of hot domestic water.
- The Domestic hot water is too hot.

Troubleshooting:

1. Inspect the tempering valve to ensure that it has not been leaking.

2. Test the tempering valve's functionality by turning the knob. If the tempering valve's knob does not turn freely, follow the instructions in this section to replace the tempering valve.

3. Test the temperature of the hot water using a digital thermometer at one of the hot water faucets. Water Temperature should range between 115° F - 123° F. If the proper range cannot be set follow the instructions in this section to replace the tempering valve.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Turn the motor home's water pump off.

2. Locate and remove the Domestic Water Access Panel

3. Drain the water pressure by opening the faucets and allowing the water to drain.

4. Disconnect the motor home's water lines from the tempering valve assembly, on top of the Aqua-Hot.

5. Remove the Tempering Valve Assembly from the Aqua-Hot.
   A. Disconnect the hot and cold water lines, located on the front of the Aqua-Hot boiler tank.
   B. Loosen the retaining nut on the Hot Water Bulkhead fitting.
   C. Remove the Tempering Valve Assembly, by lowering the assembly and pulling it out the front of the Aqua-Hot.

6. Remove the brass fittings from the defective Tempering valve.

7. Clean and wrap the threads on the brass fittings with a thread seal tape.

8. Install the brass fittings onto the replacement tempering valve.

9. Re-Install the tempering valve Assembly onto the Aqua-Hot.

10. Reconnect the hot and cold water lines onto the hot and cold pipes, located on the front of the Aqua-Hot boiler tank.

11. Re-Install the retaining nut on the Hot Water Bulkhead fitting.

12. Reconnect the motor home's water lines to the tempering valve assembly, ensuring they are plumbed correctly.

13. Turn the motor home's water pump back on and check for leaks and the presence of hot domestic water.

14. Verify that the replacement tempering valve has been set to the proper setting by taking a digital thermometer to a hot water faucet and set the water temperature between 115*F - 123*F.

15. Re-Install the Domestic Water Access Panel

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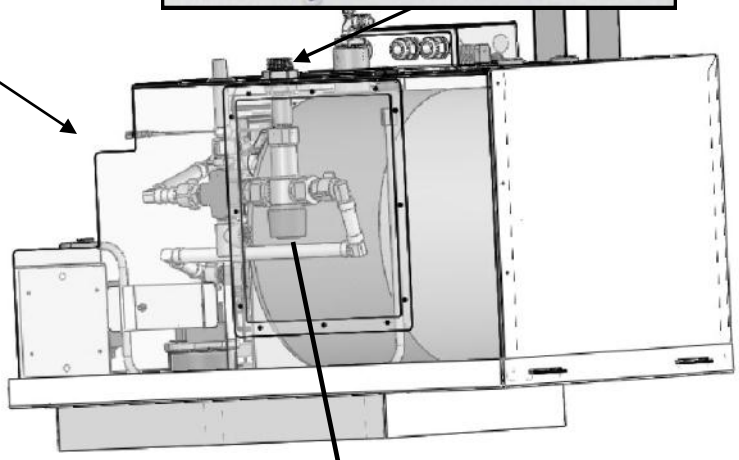
Figure 18

Bulk Head Fitting Retaining Nut

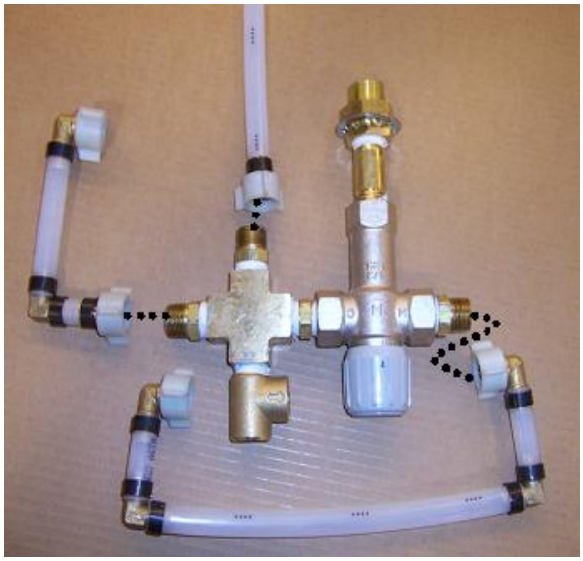
Front of Heater



Hot Water Outlet Port

Cold Water Inlet Port

Mixer Valve Assembly



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Pumps

Zone Pumps #1 and #2:

The Zone pumps first draw the heated antifreeze and water heating solution from the Aqua-Hot's boiler tank, then propel it through the Hydronic heating system's interior heat plumbing.

Troubleshoot the Zone pumps if the following condition has occurred:

- The Zone pump is not operating.
- There is a lack of heat in the coach.

Troubleshooting:

NOTE: Reference wiring Schematic in Appendix A.

1. Turn on the interior room thermostat corresponding to the Zone pump not operating.

   A. Using a Volt Meter , Check for voltage on the Fuse Block for the zone pumps, #56(WHT).
      a. If No voltage, replace the fuse.
      b. If Yes continue.

   B. Using a Volt Meter, Check and ensure that the zone relay is sending voltage to the pump at pin 4.
      a. If No voltage is present troubleshoot the zone relay.
      b. If Yes continue.

   C. Check the Zone pump for voltage.
      a. If there is voltage and the zone pump is not operating, follow the zone pump replacement procedure in this book.

NOTE: The zone pump can be tested by connecting it to an external 12 Volt-DC power source to verify that the pump is defective.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the potential for hot coolant, be sure the heater has adequately cooled.

2. Drain the antifreeze and water heating solution from the Aqua-Hot's boiler tank using the drain valve.

3. Release the pump from the mounting bracket by inserting an Awl between the locking teeth and gently prying the locking teeth apart. Then remove the defective pump from the bracket mounted to the Aqua-Hot.

4. Disconnect the defective pump's wires by pulling out on the "Red Locking Tab" on the harness plug, and separating the harness plug from the defective pump.

5. Using constant tension pliers, loosen and slide back the constant tension clamps securing the hoses to the zone pump.

6. Remove the hoses from the defective zone pump.

7. Slide the hoses back onto the replacement zone pump and set the constant tension clamps back into place.

8. Reconnect the harness plug into the replacement pump. Be sure to push in on the red locking tab, to secure the plug to the replacement pump.

9. Install the replacement pump onto the mounting bracket, and squeeze the pump bracket together with a pair of channel lock pliers, to secure the pump.

10. Refill the Aqua-Hot's boiler tank with the antifreeze and water heating solution. Reference Section 5 for filling instructions.

11. Test the Aqua-Hot for normal operation.

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Figure 19

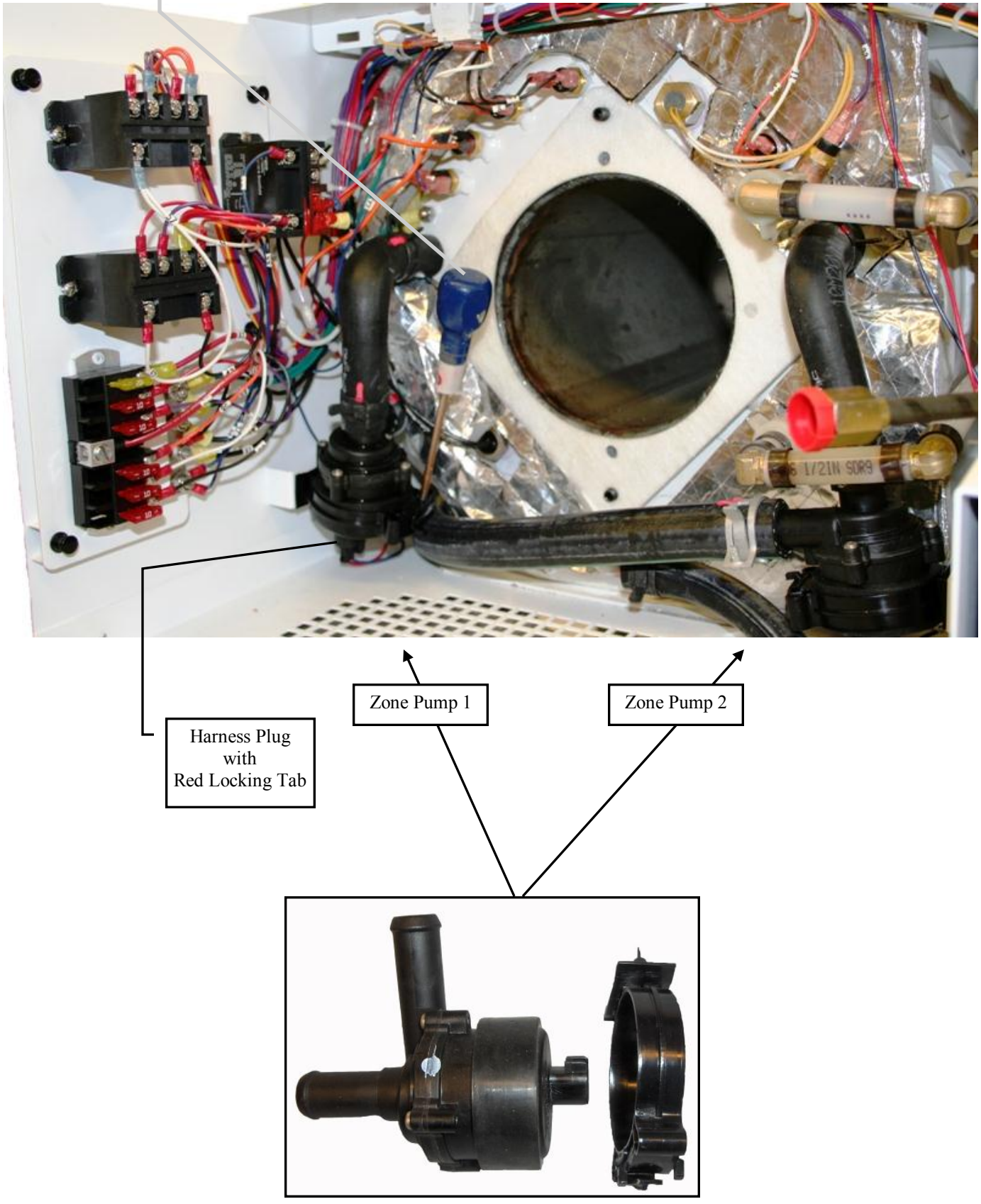
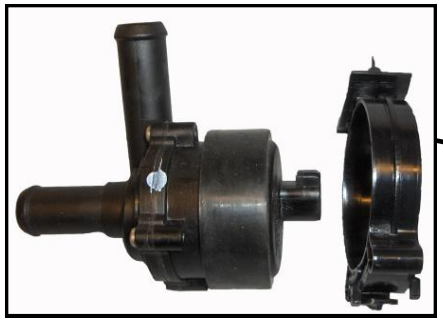
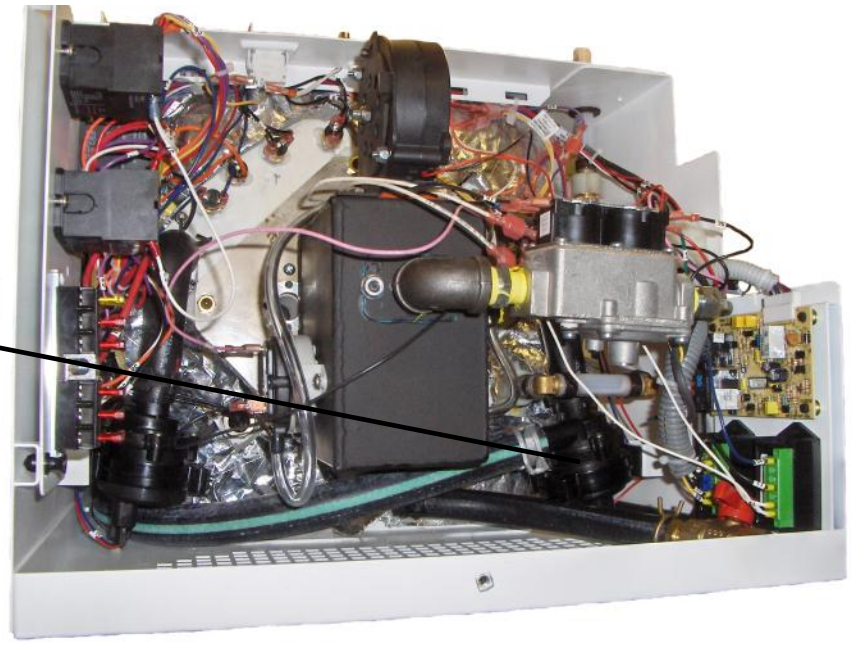

Awl Inserted into the mounting bracket
Zone Pump 1
Zone Pump 2
Harness Plug with Red Locking Tab

Figure 20

Zone Pump 2/Stir Pump





Stir Pump (Zone Pump #2):

The stir pump circulates the antifreeze and water heating solution within the Aqua-Hot's boiler tank in order to ensure even-heating of the solution. To accomplish this, the stir pump draws the solution from the bottom of the tank and deposits it back into the top of the tank, after circulation through Heating Loop #2.

Troubleshoot the stir pump if the following condition has occurred:

- There is a lack of hot domestic water.

Troubleshooting:

NOTE: In order for the stir pump to operate, the Propane burner combustion blower fan must be running.

1. Verify that the Propane Burner combustion blower fan is running.

2. If the Propane burner combustion blower fan is running and the stir pump still is not operating:

   A. Using a Volt Meter, test for dc voltage at the Pro pane burner electronic controller, at the #45 red wire.

   If Propane-Burner combustion blower fan is running, and no voltage is present at the #45 wire, check Combustion Blower Fan Buck Boost for power at the red #93 wire. If no power is present Trouble shoot the Combustion Blower Fan Buck Boost.

   B. Using a Volt Meter check the zone 2 relay for voltage on the #4 pin.

   If there is no voltage at zone 2 relay, check wire #45 for damage.

   C. Using a Volt Meter check the #2 zone pump for voltage.

   If voltage is present and the pump still fails to operate follow the circulation pump replacement procedure in this book.

3. If it is determined that the pump is active, verify that the pump is operating properly by checking both connected hoses for heat.

   If both hoses are hot, the pump is working properly.

   If one hose is hot, or neither hose is hot:
   1. check the cold hose for a blockage.
   2. Trouble Shoot the Zone Check Valve

   If no blockage exists on either hose, and it is determined the check valve is not stuck: follow the instructions in this section to replace the Zone pump #2.

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Electrical - AC

Electric Heating Element:

The electric heating element uses AC power as an alternate power source for heating the Aqua-Hot's boiler tank.

Troubleshoot the electric heating element if the following condition has occurred:

- There is a lack of hot domestic water and interior heat when the electric element is selected as the heating source.

Troubleshooting:

NOTE: For continuous domestic hot water to be present, the Propane-Burner must be selected also as a heating source.

1. Verify that the motor home is either plugged into shore power or that the generator is running to provide AC power.

2. Verify that the "Electric" Switch is in the ON position, on the interior switch panel inside the motor home.

3. Using a Volt Meter, Verify the presence of 12vdc voltage at the terminal block on both the AI (power in from the switch) and AO (power out to the switch) pins.

   If there is no 12VDC voltage present, complete the following:

   A. Verify that the electric element switch on the interior switch panel is on.
   B. Verify that the heater is full of antifreeze. If the heater is full of antifreeze, verify the Float Switch is functioning properly.
   C. Install a jumper wire on the terminal block, between the AI and AO pins to bypass the electric element switch.

   If the "Electric Heating Element " works with the jumper wire installed, replace the Electric Switch, on the interior switch panel.

If the Electric Switch is on, and operating properly:

A. Check the temperature of the Aqua-Hot's boiler tank.

If the boiler tank temperature is below 158°F, Verify that the control thermostat for the electric element is operating properly.

If the boiler tank is above 185°F, the Aqua-Hot is at operating temperature and requires no heat.

4. Check functionality of the A.C. Relay. Refer to A.C. Relay troubleshooting, in this section.

5. Verify that the electric heating element is receiving adequate AC power by completing the following:

A. Remove the AC access cover.

B. Using an AC voltmeter, verify that 110 volts of AC power are present.

C. Using a digital clamp on amp-meter, verify that 11.2 to 13 amps are present at the element's wires.

NOTE: If there is 11.2 to 13 amps of A.C. Current present the electric element is operating properly.

D. Disconnect the coach from shore power/turn off generator and Check the electric element's wires for continuity by completing the following:

a. Disconnect the wires from the electric heating element.

b. Disconnect the wires from the AC terminal block.

c. Check the black and white wires, individually, for continuity.

5. Check the electric heating element for functionality by completing the following:

A. Disconnect all power supplies.

B. Remove all wires from the electric heating element.

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C. Using a digital volt meter, set to register ohms, check the electric heating element for the proper ohms, reading of 10 - 11 Ohms

If the proper ohms do not exist follow the instructions in this section to replace the electric heating element.

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.

2. Drain the antifreeze and water heating solution from the Aqua-Hot's boiler tank using the drain valve.

3. Remove the Propane-Burner. Reference Section 7.

4. Remove the two wires secured to the defective electric heating element by cutting them with wire cutters.

5. Using a 7/8 inch socket, remove the defective electric heating element from the Aqua-Hot's boiler tank.

6. Wrap the new electric element threads with a thread seal tape.

7. Install the replacement 1500-watt electric heating element into the boiler tank, and securely tighten .

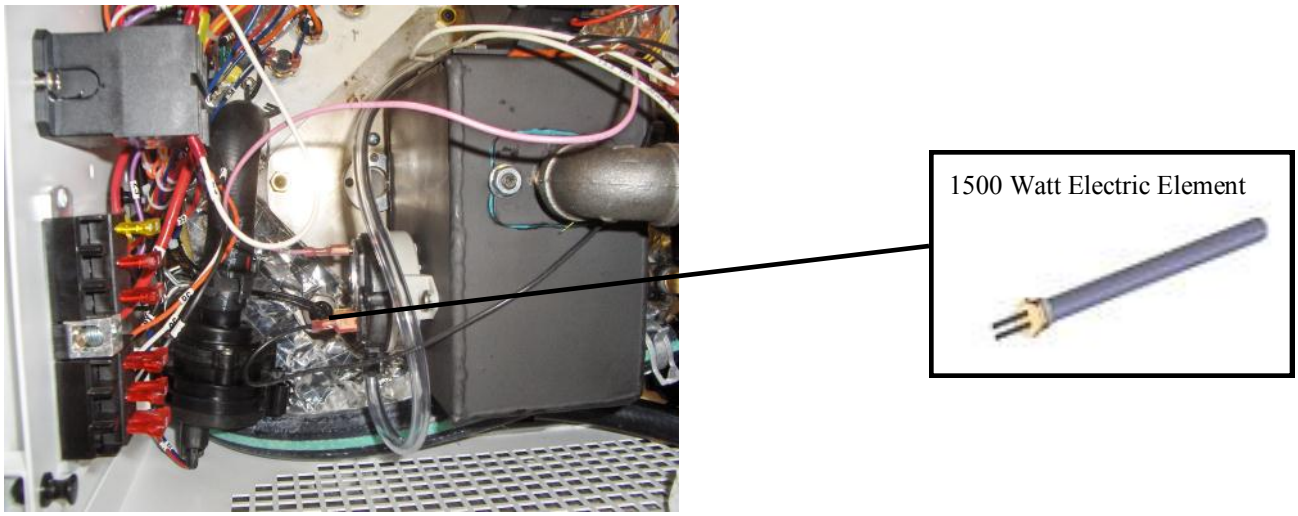
8. Connect the wires removed from the defective electric heating element to the replacement electric heating element utilizing crimp terminals.

9. Reinstall the propane burner. Reference Section 7.

10. Refill the Aqua-Hot's boiler tank with the antifreeze and water heating solution. Reference Section 5.

11. Test for proper operation.

Figure 21



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AC Relay:

The AC relay is an electrical device where the DC circuit from the electric switch determines whether the AC power is permitted to flow to the electric heating element. This allows the 12 VDC electric switch to switch the 120 VAC electric heating element on and off in conjunction with the interior switch panel and control thermostat even though the electric heating element is on a separate circuit.

Troubleshoot the AC relay if the following condition has occurred:

- The electric heating element fails to operate.

Troubleshooting:

1. Disconnect the AC power source to the motor home (unplugging from shore power or shutting off the generator).

2. Turn the electric element switch on the interior switch panel to the ON position.

3. Verify the Following:
A. The Electric Element Switch is operating properly
B. The Control Thermostat is Calling for heat.
C. The Float Switch is functioning properly.

4. Using a voltmeter, check pin AI on the terminal block for 12 Volts-DC. If no voltage is present:

A. Check the B fuse on fuse block, for power. If no power is present check fuse.
B. If fuse is good, follow the troubleshooting guide for the float switch.

5. Using a Voltmeter check pin A0, on terminal block, for power.
A. If no power is present follow troubleshooting guide for the electric element switch.

B. If 12 Volts of DC power are present, continue:

6. Locate the VAC relay.
A. Check pins 1 & 0 for 12 VDC power and ground.
1. Pin 1 is - and Pin 0 is +.

If there is no 12VDC + and - present:
1. check wires for damage or loose connections.
2. Follow the instructions in this manual for trouble shoot the Electric element Control thermostat.

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIOUS DAMAGE OR PERSONAL INJURY.

B. Ensure that all the A.C. power supplies to the coach have been disconnected.

1. Turn the electric switch to the on position and Verify it is sending 12VDC power to the A.C. relay.

2. Locate the AC wires connected to the AC relay (pins 4 and 2), and remove the AC wires from the relay.

3. Using an ohmmeter, check the relay AC pins (4 and 2) for continuity.

If no continuity exists, follow the instructions in this section to replace the AC relay.

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AC Relay:

Replacement Procedure:

⚠ DANGER! ⚠

FAILURE TO DISCONNECT ALL POWER SUPPLIES AND/OR TO ALLOW THE HEATER TO COOL BEFORE SERVICING COULD CAUSE SERIUOS DAMAGE OR PERSONAL INJURY.

1. Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected.
2. Also, ensure that the motor home is not connected to shore power and that a generator is not running during this replacement procedure.
3. Locate the A.C. Relay on side of unit, Reference Figure 22 for location of A.C. Relay.
4. Release the wires from the defective A.C. relay by removing the corresponding screw terminals.
5. Remove A.C. Relay from the side of the heater.
6. Attach the replacement A.C. relay to the side of heater.
7. Using the wiring diagram in Appendix A, connect the wires previously removed, to the replacement AC relay.
8. Test for proper operation.

NOTE: The motor home must be plugged into shore power or the generator must be running for the electric element to be operational.

Figure 22

A.C. Relay

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Zone Relay: Interior Heat Exchanger Fans

The Zone relay is an electrical device where the DC circuit from the Interior Room Thermostat determines whether the DC power is permitted to flow to the circulation pump and the heat exchanger fans. This allows the Interior Room Thermostat to switch both the fans and circulation pump on.

Troubleshoot the Zone relay if either of the following conditions have occurred:

- The Interior fans fail to operate.
- The circulation pump fails to operate

Troubleshooting:

If the Interior heat exchanger Fans fail to operate:

1. Turn the corresponding room thermostat on, on the interior of the motor home, ensuring the thermostat is set at the maximum heat setting, to ensure they will call for heat.

2. Since the Aqua-Hot 375-LP is a hot water priority system, make sure the Low Temperature cut-off Thermostat is not tripped, by Making sure the heater is up to operating temperature, and that domestic hot water is NOT being used. Reference the Low Temperature Cut-off thermostat troubleshooting in this section.

3. Locate the Fuse block, and using a volt meter, check for 12VDC on the C Fuse.
   If no power is present check fuse.

4. On the zone relay, check pin 6 for 12 VDC +.
   If no power is present inspect wire #24 for damage.

5. On the Zone relay check pin 1 for 12 VDC +
   If no power is present check E fuse

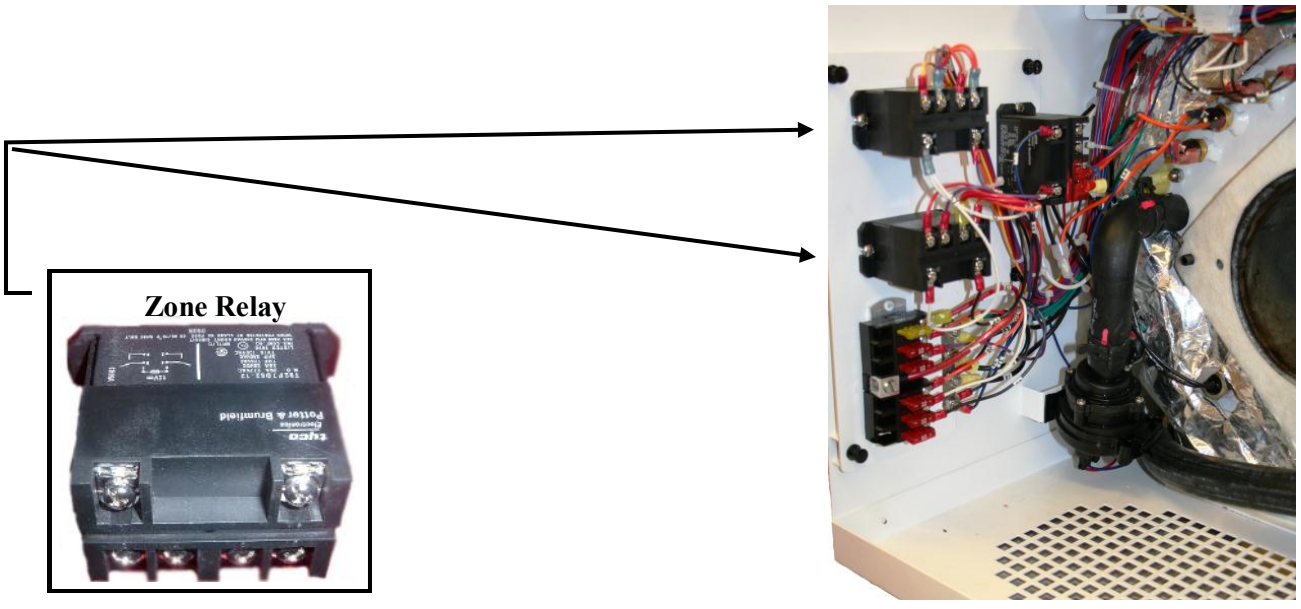
6. On the Zone Relay check pin 0 for ground.
   If there is not a ground present, verify that the room thermostat is calling for heat, and that it is sending a ground signal to the relay.

NOTE: If there is no ground for pin 0, it is possible to bypass the motor homes' interior room thermostat by supplying an external ground to the terminal block for the particular zone being trouble shot. If the zone works with the interior room thermostat bypassed the problem is located in the motor home, not within the heating system.

5. On the zone relay, check pin #8 for 12 VDC +.

   If no voltage is present follow the replacement procedure for the zone relay in this section.

Figure 23



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Zone Relay: - Circulation Pump

The Zone relay is an electrical device where the DC circuit from the Interior Room Thermostat determines whether the DC power is permitted to flow to the circulation pump and the heat exchanger fans. This allows the Interior Room Thermostat to switch both the fans and circulation pump on.

Troubleshoot the Zone relay if either of the following conditions have occurred:

- The Interior fans fail to operate.
- The circulation pump fails to operate

Troubleshooting:

If the Circulation Pump Fails to operate:

1. Turn the corresponding room thermostat on, on the interior of the motor home, ensuring the thermostat is set at the maximum heat setting, to ensure they will call for heat.

NOTE: Even though the Aqua-Hot 375 is a Hot Water Priority system, and utilizes a Low Temperature Cut-Off thermostat to shut the heat exchanger fans off, on the inside of the motor home, this function does not shut down the circulation pumps. It only shuts the interior heat exchanger fans off, and therefore will not cause the pumps to not operate.

2. Locate the Fuse block, and using a volt meter, check for 12VDC on the D Fuse.
   If no power is present check fuse.

3. On the zone relay, check pin 2 for 12 VDC +.
   If no power is present inspect wire #58/#59 for damage.

4. On the Zone relay check pin 1 for 12 VDC +
   If no power is present check E fuse

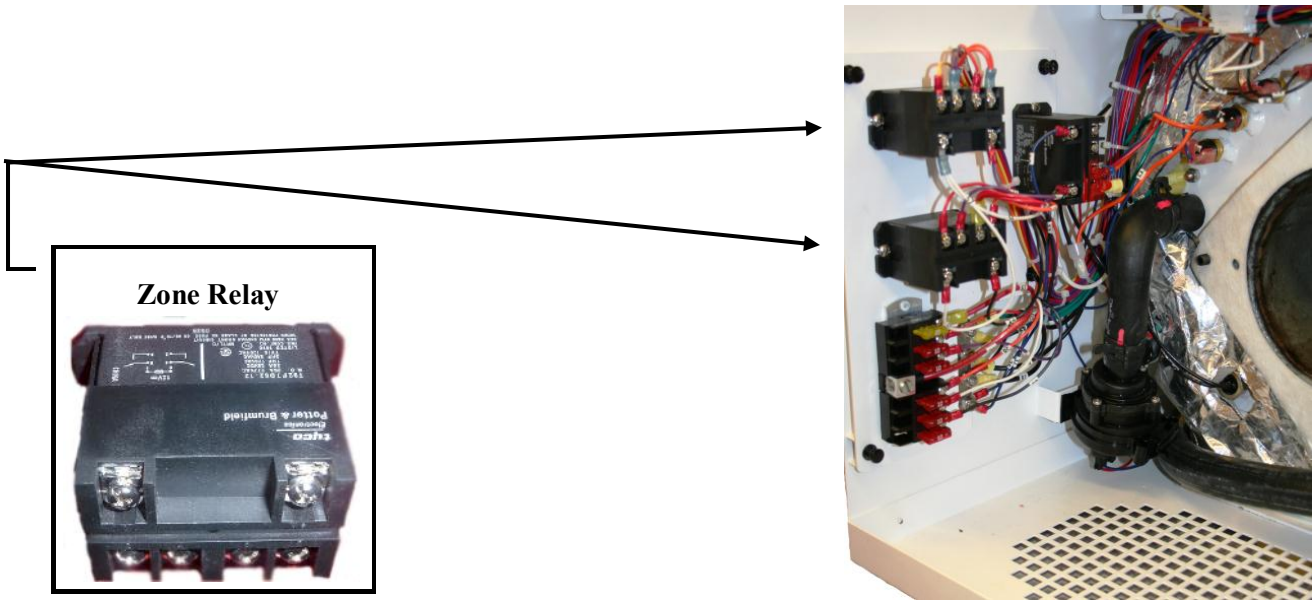
5. On the Zone Relay check pin 0 for ground.
   If there is not a ground present, verify that the room thermostat is calling for heat, and that it is sending a ground signal to the relay.

NOTE: If there is no ground for pin 0, it is possible to bypass the motor homes' interior room thermostat by supplying an external ground to the terminal block for the particular zone being trouble shot. If the zone works with the interior room thermostat bypassed the problem is located in the motor home, not within the heating system.

6. On the zone relay, check pin #4 for 12 VDC +.

   If no voltage is present follow the replacement procedure for the zone relay in this section.

Figure 24



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WARNING!

Only propylene glycol based "boiler" type antifreeze deemed "GRAS" (Generally Recognized as Safe) by the FDA shall be used in the Aqua-Hot's Hydronic heating system. Failure to use the above specified antifreeze type could result in serious injury or death.

CAUTION:

Ensure that the overflow tube is connected from the Aqua-Hot's expansion tank connection to the expansion tank's bottom connection and from the expansion tank's top connection through the overflow tube hole in the motor home's bay floor prior to beginning this antifreeze and water heating solution fill procedure. Failure to do so could result in an antifreeze spill in the motor home's bay. Reference Figure 30.

Figure 25

Filling the Hydronic Heating System:

In order to provide the best freeze protection, boil-over protection, and anti-corrosion and rust protection, a 50/50 mixture of "GRAS" approved propylene glycol boiler antifreeze and water is recommended.

Reference Section 1: Antifreeze and Water Heating Solution for additional information regarding the antifreeze and water heating solution. Be sure to use a "GRAS" boiler-type propylene glycol based antifreeze rather than an RV and Marine antifreeze or an automotive antifreeze/coolant.

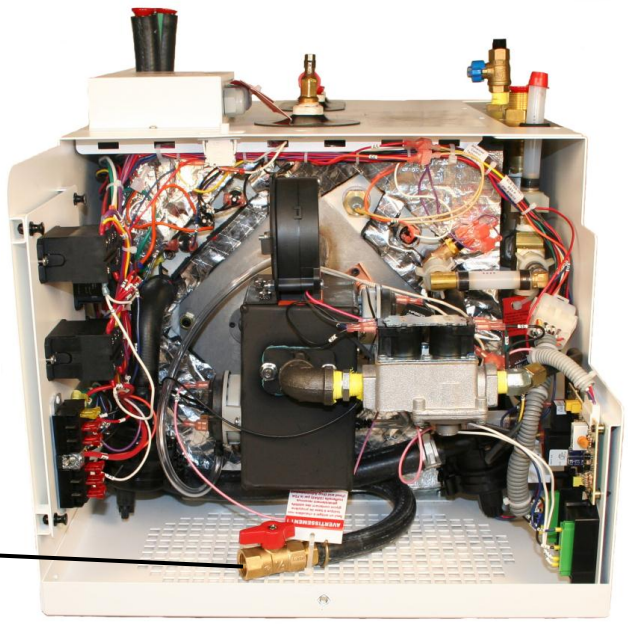
If assistance is needed in selecting an appropriate antifreeze, please contact the Aqua-Hot Heating Systems Product Application Department at 1-800-685-4298.

1. Open the Aqua-Hot's drain valve located at the front of the heater. Reference Figure 25.

2. Connect a piece of 1/2 inch PEX-type tubing to the drain valve. This piece should be long enough to transport the antifreeze and water heating solution from its source to the Aqua-Hot.

NOTE: It is recommended to use a pump, and pump the antifreeze into the boiler tank, through the drain valve.

Figure 26



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3. Fill the Aqua-Hot completely with the 50/50 mixture of antifreeze and water heating solution. This will take approximately five gallons; look for the solution to enter the overflow tube attached to the expansion tank connection on top of the Aqua-Hot.

4. When refilling, open the air-release valve located on the expansion tank connection to release air pockets. Reference Figure 24. Hold the valve open until all air is released. Be sure the valve is closed when finished by hand-tightening. Look for the solution to enter the overflow tube attached to the expansion tank connection on top of the Aqua-Hot.

5. Close the drain valve.

Purging the System by Grounding the Zone Thermostat Connection:

1. Ensure that the boiler tank has been filled with the appropriate mixture of antifreeze and water heating solution.

2. Locate Terminal Block for switches, heat exchangers, fans and thermostats. Reference Figure 26.

3. Locate the thermostat connection terminals T1 and T2. Reference Figure 27.

4. Connect a wire to the desired zone terminal to be purged and connect the opposite end of the cable to a ground source. Reference Figure 27.

NOTE: The circulation pump will activate as soon as the terminal is connected to a ground source; therefore, disconnect the wire from the ground source during the antifreeze and water heating solution filling procedure.

5. Allow the circulation pump to operate for approximately 1-3 minutes in order to purge the corresponding heating loop, then remove the wire from the ground source.

6. Open the drain valve and completely fill the Aqua-Hot's boiler tank with additional antifreeze and water heating solution.

7. Repeat steps 5 and 6 for both heating loops until all air has been completely bled from the entire heating system.

NOTE: All air is bled from the heating system when the antifreeze solution enters the boiler tank on the inlet ports, for the interior zone heating loops, and fluid comes out of the expansion tank port.

8. Once the systems have been purged, disconnect the wire from the ground source and the terminal block.

9. Check the Aqua-Hot's expansion tank and top it off to the cold level mark with the 50/50 antifreeze and water mixture, if necessary.

10. Ensure that each thermostat's connection wiring is still in its original configuration. Reference Appendix A.

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Figure 27

Terminal Block for Switches, Heat Exchanger Fans and Thermostats

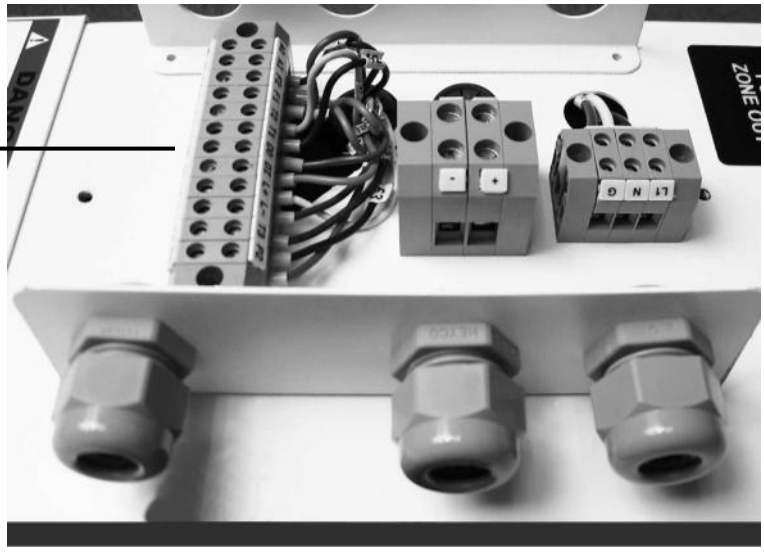
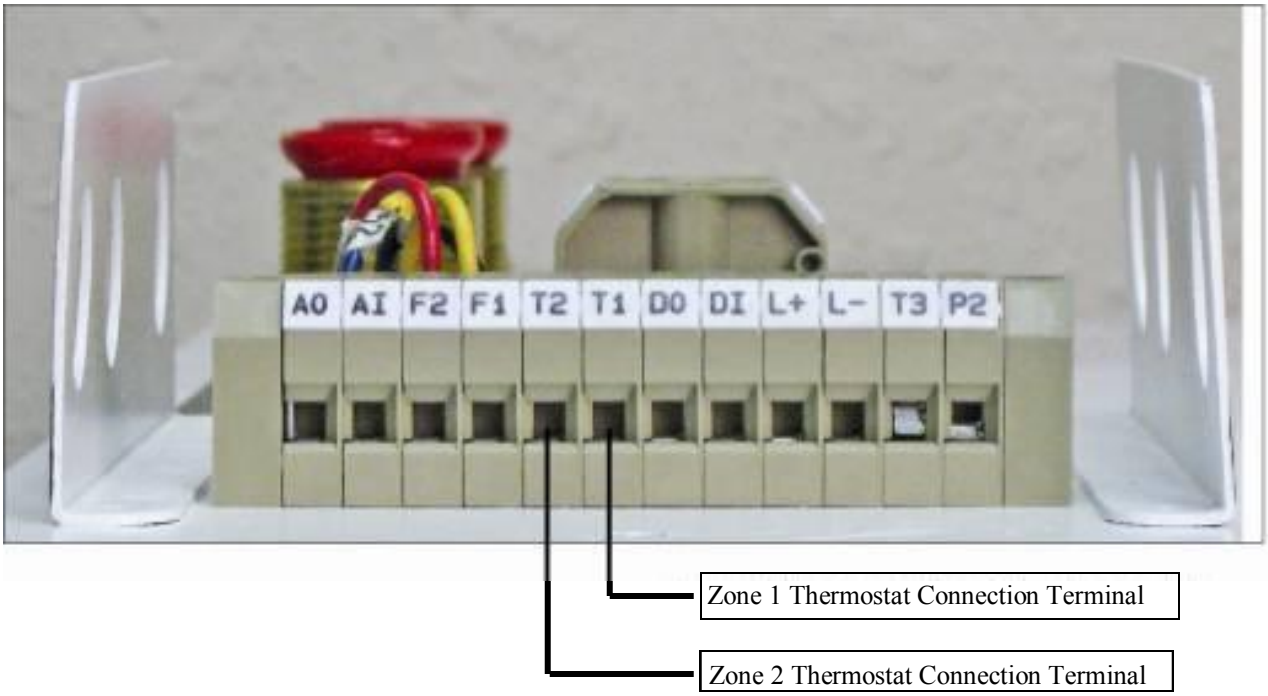


Figure 28



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WARNING!

Only propylene glycol based "boiler" type antifreeze deemed "GRAS" (Generally Recognized as Safe) by the FDA shall be used in the Aqua-Hot's Hydronic heating system. Failure to use the above specified antifreeze type could result in serious injury or death.

CAUTION:

Ensure that the overflow tube is connected from the Aqua-Hot's expansion tank connection to the expansion tank's bottom connection and from the expansion tank's top connection through the overflow tube hole in the motor home's bay floor prior to beginning this antifreeze and water heating solution fill procedure. Failure to do so could result in an antifreeze spill in the motor home's bay. Reference Figure 30.

In order to provide the best freeze protection, boil-over protection, and anti-corrosion and rust protection, a 50/50 mixture of "GRAS" approved propylene glycol boiler antifreeze and water is recommended.

Reference Section 1: Antifreeze and Water Heating Solution for additional information regarding the antifreeze and water heating solution. Be sure to use a "GRAS" boiler-type propylene glycol based antifreeze rather than an RV and Marine antifreeze or an automotive antifreeze/coolant.

If assistance is needed in selecting an appropriate antifreeze, please contact the Aqua-Hot Heating Systems Product Application Department at 1-800-685-4298.

TO DRAIN THE AQUA-HOT

WARNING!

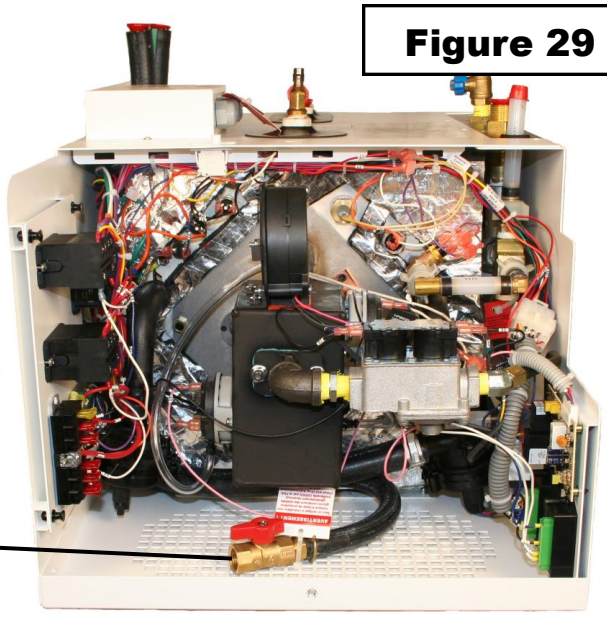
Ensure that the Aqua-Hot has been completely shut down and that all power sources have been disconnected. Also, because this replacement procedure will involve the boiler tank and the potential for hot coolant, be sure the heater has adequately cooled.

1. Connect a piece of 1/2 inch PEX-type tubing or rubber hose to the drain valve. This piece should be long enough to transport the antifreeze and water heating solution from the Aqua-hot to a bucket.

2. Open the Aqua-Hot's drain valve located at the front of the heater. Reference Figure 27.

Note: The Aqua-Hot 375 holds approximately 5 gallons of the antifreeze and water heating solution.

Figure 29



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General Recommended Maintenance

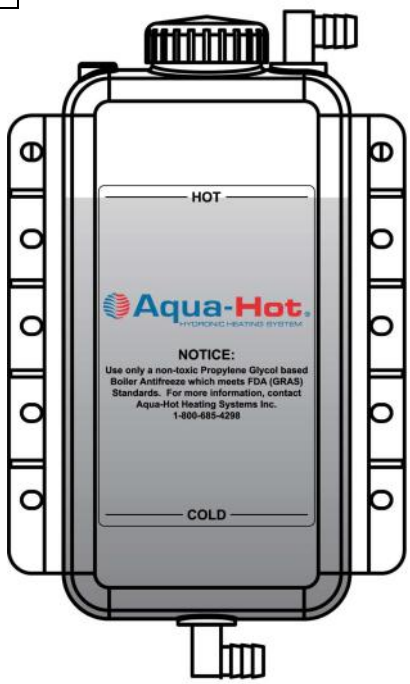
Monthly

Check the Aqua-Hot's antifreeze and water heating solution to ensure that it is filled to the proper level. This solution level should be checked in the Aqua-Hot's Expansion Tank and should **only** be checked when the Aqua-Hot is at maximum operating temperature (i.e., when the Propane-Burner cycles **OFF** at 190±5°F). The antifreeze and water heating solution's level should be at the "**HOT**" mark on the Expansion Tank; reference Figure 30.

If the antifreeze and water heating solution needs replenishing, fill the Aqua-Hot's Expansion Tank to the **"HOT"** level mark. Be sure to reference Section 1: Antifreeze and Water Heating Solution for the proper antifreeze type and mixture. If the antifreeze and water heating solution frequently needs replenishing, please contact the Aqua-Hot Heating Systems Technical Department at 1-800-685-4298 for assistance.

Figure 30

Expansion Tank


HOT
Aqua-Hot
NOTICE:
Use only a non-toxic Propylene Glycol based Boiler Antifreeze which meets FDA (GRAS) Standards. For more information, contact Aqua-Hot Heating Systems Inc. 1-800-685-4298
COLD

The antifreeze and water heating solution should be filled to the "HOT" level on the Expansion Tank when the Aqua-Hot is at the maximum operating temperature.

Annually

⚠ DANGER! ⚠

The Aqua-Hot operates on both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply prior to cleaning or servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

WARNING!

Operating the Aqua-Hot's Propane-Burner or the 120 Volt-AC Electric Heating Element without the antifreeze and water heating solution will cause serious damage to the heater.

There is no recommended Annual Service for the Propane-Burner. If it fails to operate refer to the Propane-Burner Trouble shooting section in this manual.

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Figure 31

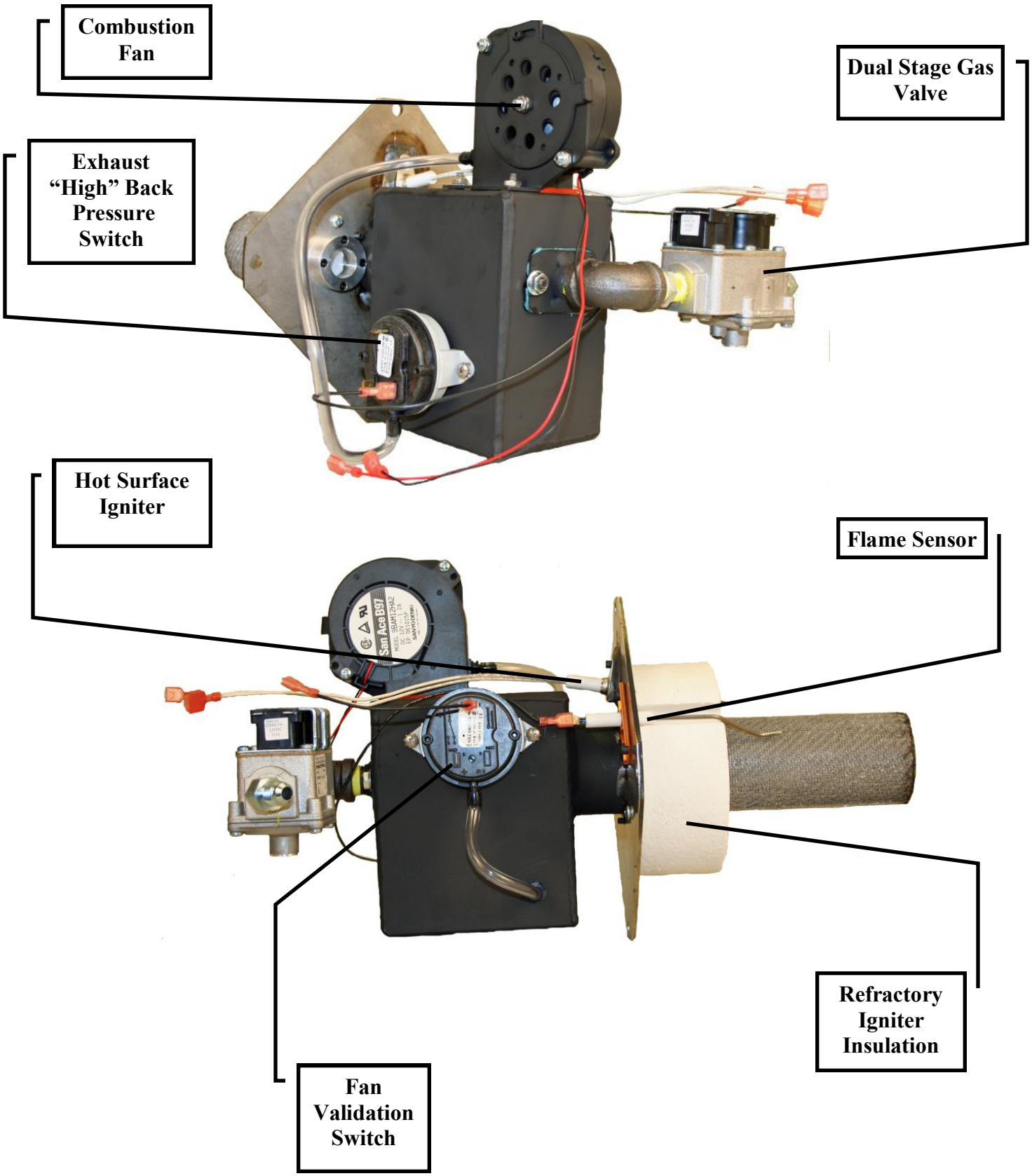

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Figure 32

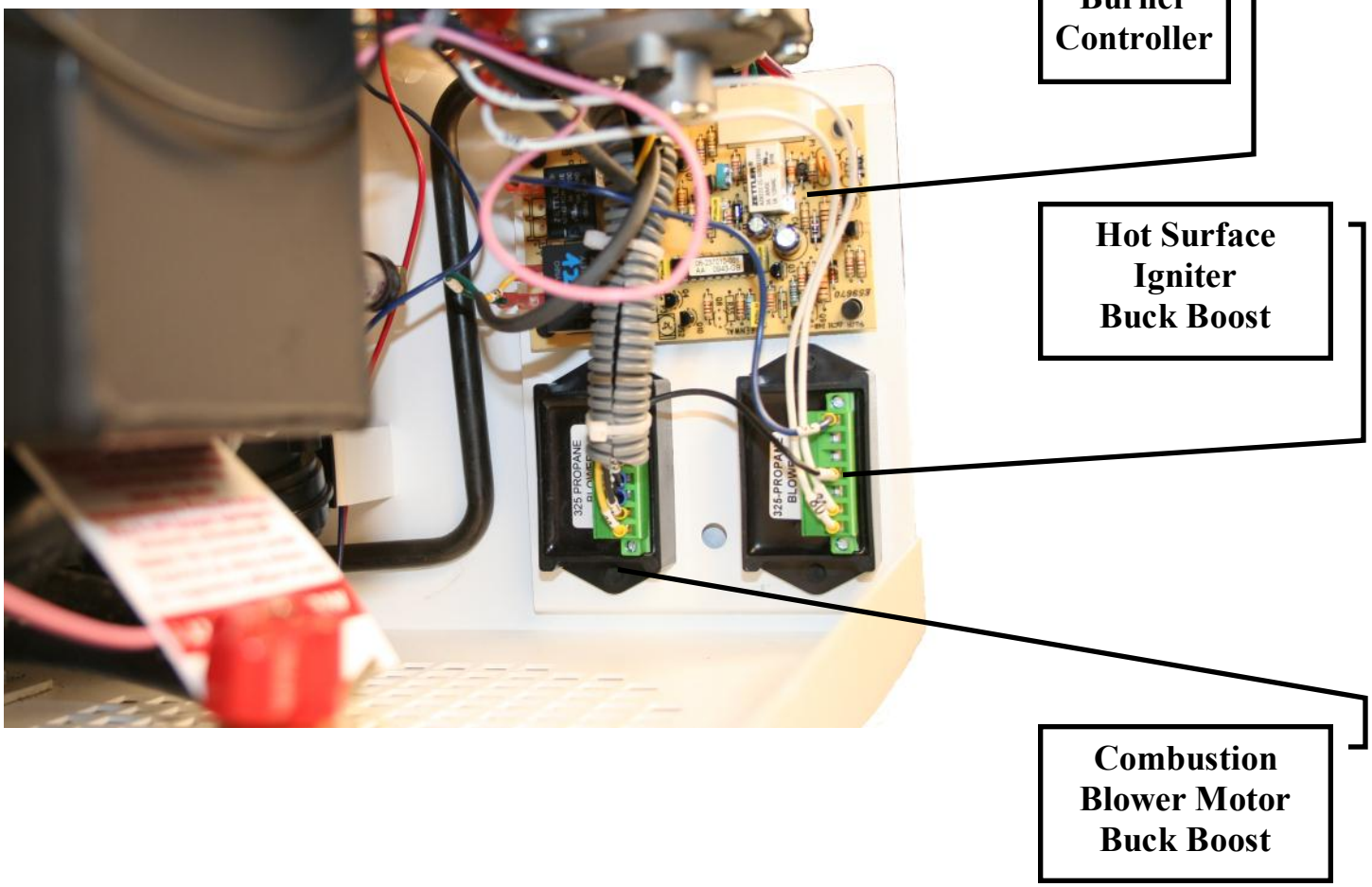

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Chart 2

1. The Interior Switch Panel's Propane-Burner switch is moved to the ON position authorizing the Propane burner to be used as a heat source.

2. The Indicator Light on the Interior Switch Panel's Propane-Burner switch is illuminated.

3. The Control Thermostat is checked to determine if there is a need for additional heat.

4. The Combustion Blower Fan is Activated for 15 seconds.

5. The Fan Validation Switch verifies the Combustion Blower Fan is operating.

6. The Hot Surface Igniter is activated for 8 seconds.

7. The Dual Stage Gas Valve is activated, which allows the propane gas to enter into the Combustion Chamber where it mixes with air and is ignited by the Hot Surface Igniter.

8. The Flame Sensor verifies that a flame is present.

NO → Inter-Purge 10 seconds → 2 Times → back to step 6

YES

9. Hot surface igniter is de-activated.

10. The Control Thermostat is checked to ensure there is still a need for heat.

11. The Propane-Burner Controller continues to run through a cycle of the following checks until one of these scenarios does not check out:

- Checking for a flame
- Checking that the Control Thermostat is still calling for heat
- Checking that the interior switch Panel's Propane-Burner Switch is still in the ON position.
- Checking that the High-Limit Thermostats have not over-temped
- Checking that the Interlock Switch has not been tripped

12. The Propane-Burner begins a shut-down procedure when one of the following occurs:

- The flame extinguishes
- The Control Thermostat signals that there is no longer a need for heat.
- The Propane-Burner switch, on the Interior Switch Panel, is turned to the OFF position.
- Either of the High-Limit Thermostats over-temp.
- The Interlock Switch is tripped

13. The Dual-Stage Gas Valve is deactivated.

14. A 2-Mintue Purge Cycle takes place.

15. The Combustion Blower Motor is deactivated

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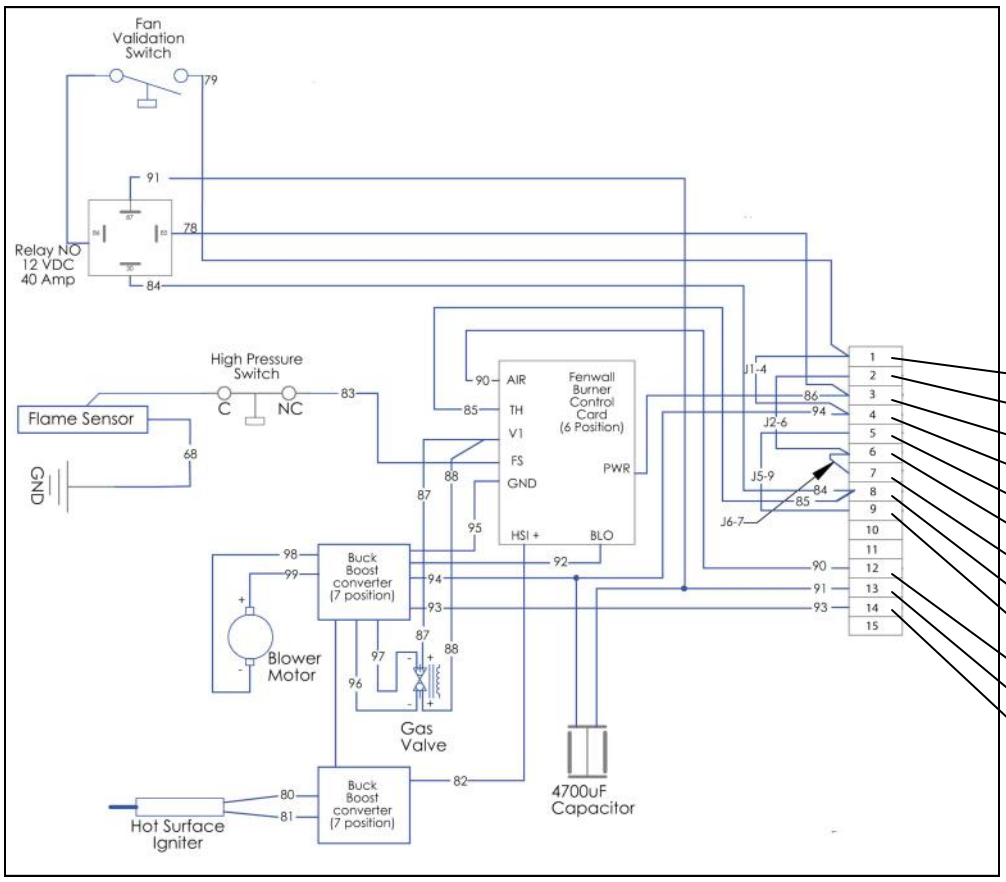
Figure 34



1 - Indicator Light (-)
2 - Indicator Light (+)
3 - A-Fuse
4 - Ground
5 - Thermostat Orange
6 - Thermostat White
7 - Interlock Switch
8 - Left High Limit Thermostat
9 - Left High Limit Thermostat
12 - Right High Limit Thermostat
13 - Right High Limit Thermostat
14 - Stir Pump

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Instructions for Detaching the Propane-Burner

WARNING!

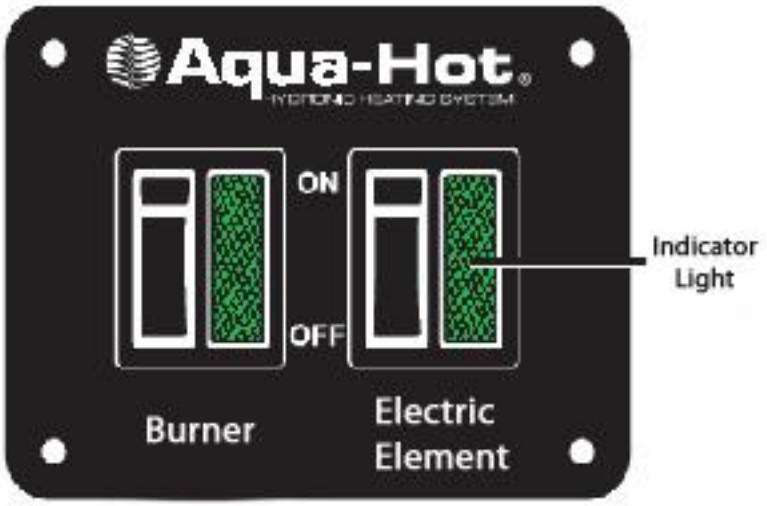
Be sure to move the Burner switch on the Interior Switch Panel to the OFF position and disconnect the Propane -Burner's power supply before detaching the Propane-Burner from the Aqua-Hot. Failure to turn off the Propane-Burner and disconnect power could result in serious bodily injury.

CAUTION!

Be sure to turn off the Propane Fuel Supply at the port on top of the Aqua-Hot prior to beginning this replacement procedure.

Step 1: Turn Off the Propane-Burner Switch

Figure 37

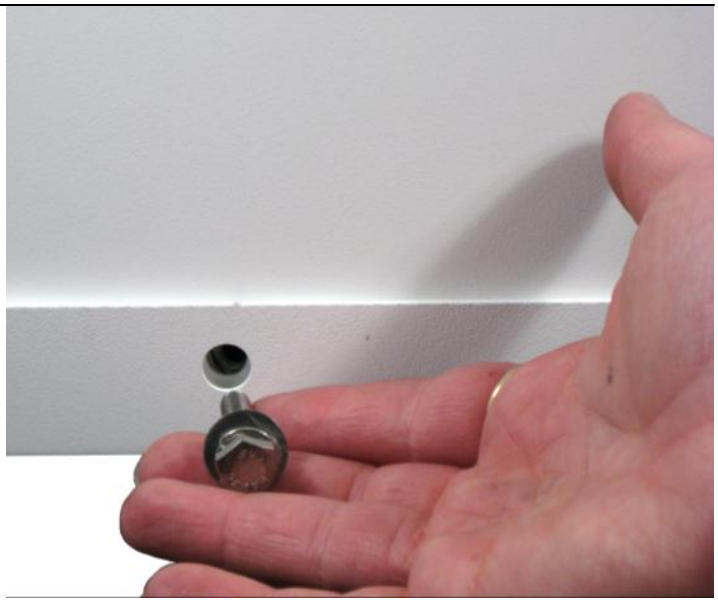


1. **Move the Interior Switch Panel's Propane-Burner switch to the "OFF" position.**

Step 2: Remove the Access Cover

Figure 38

1. **Remove the Aqua-Hot's access cover by locating the bolts securing it in place.**



2. **Unscrew the bolt securing the front of the cover in place.**

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3. Unscrew the bolt securing the top of the cover in place.

Figure 39

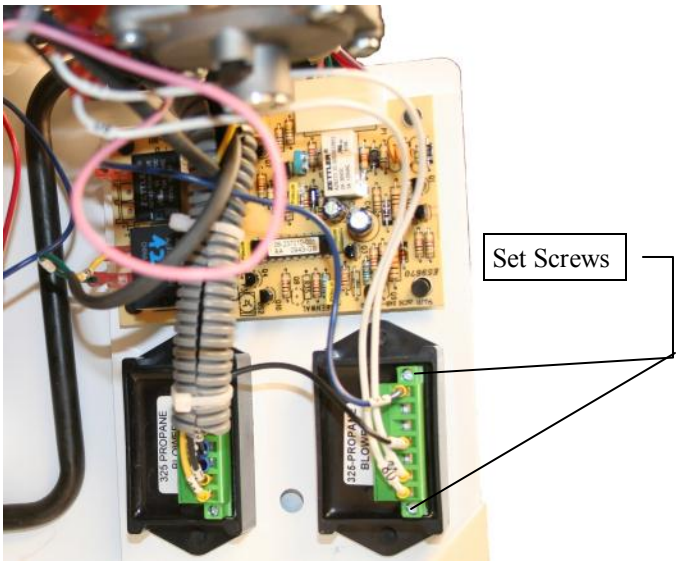
4. Lift the access cover off and set it aside.

Figure 39A

Step 3: Disconnect the Propane-Burner from the Propane-Burner Controller

1. Locate both the Propane-Burner's white, electrical plug connection to the Propane-Burner Controller and both of the green plug connections to the Buck Boosts.

Figure 40



2. Loosen the set screws, securing the green plugs to the buck boosts,

Figure 40A

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Figure 41

3. **Pull the plugs completely out of the Propane-Burner Controller and the Buck Boosts.**

NOTE: There are also 3 wires connected to the propane-burner controller, that will need to be removed, by firmly pulling on the quick connect terminals.

Step 4: Remove the fuel line from the Propane-Burner

CAUTION!

Be sure to turn off the Propane Fuel Supply at the port on top of the Aqua-Hot prior to beginning this procedure.

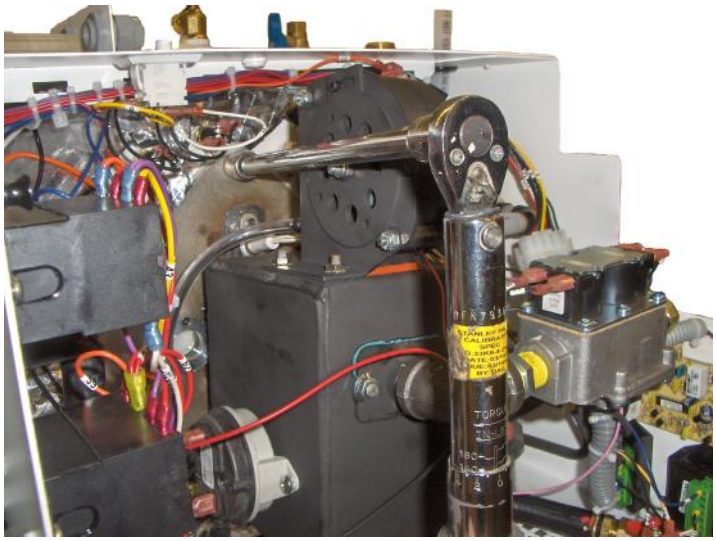
1. **Locate the gas valve assembly on the Propane-Burner and the corresponding fuel lines.**

Figure 42

2. **Using an 11/16 wrench, loosen the nut securing the fuel line to the gas valve assembly.**

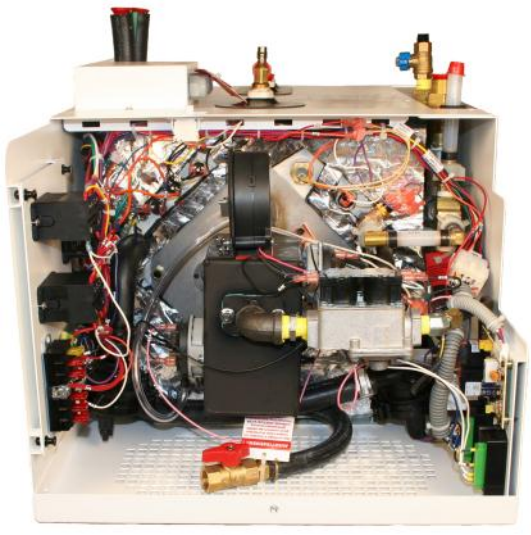
Figure 42A

Step 5: Remove the Propane-Burner from the Aqua-Hot



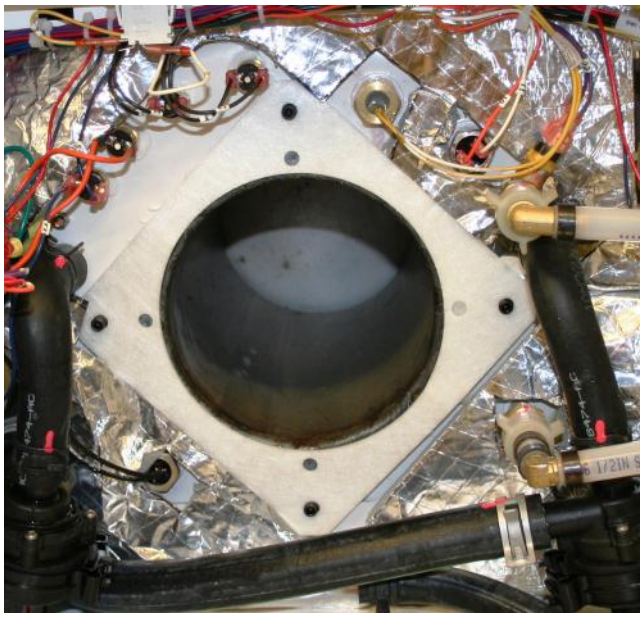
1. The Propane-Burner is secured to the Aqua-Hot with four nuts that can be removed by using a 9/16 inch socket wrench with a wobble extension.

Figure 43



2. Carefully lift the Propane-Burner away from the Aqua-Hot.

Figure 44



3. Remove the Mounting Gasket from the boiler tank's front plate and the Propane-Burner.

Figure 45

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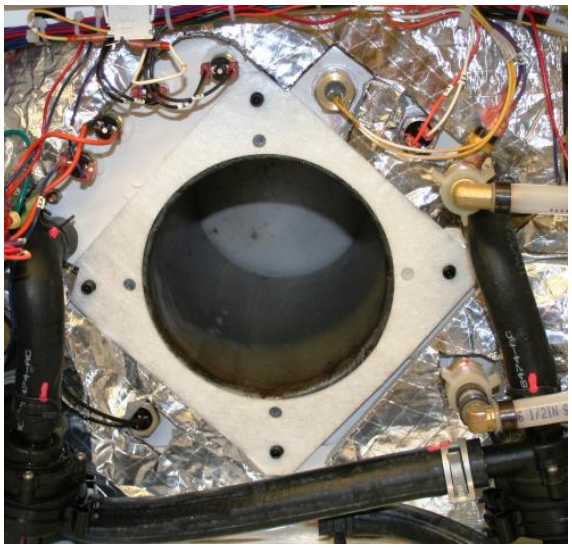
Instructions for Reattaching the Propane-Burner

Step 1: Replace the Mounting Gasket

1. Clean the boiler tank's front plate.

Figure 46



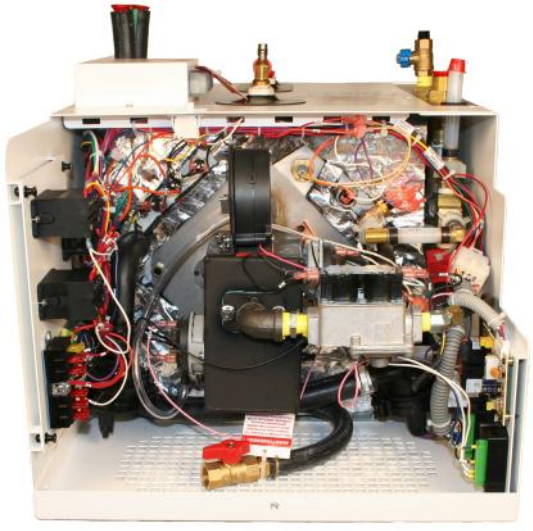
2. Install a new mounting gasket into place.

Figure 47

Step 2: Reinstall the Propane-Burner

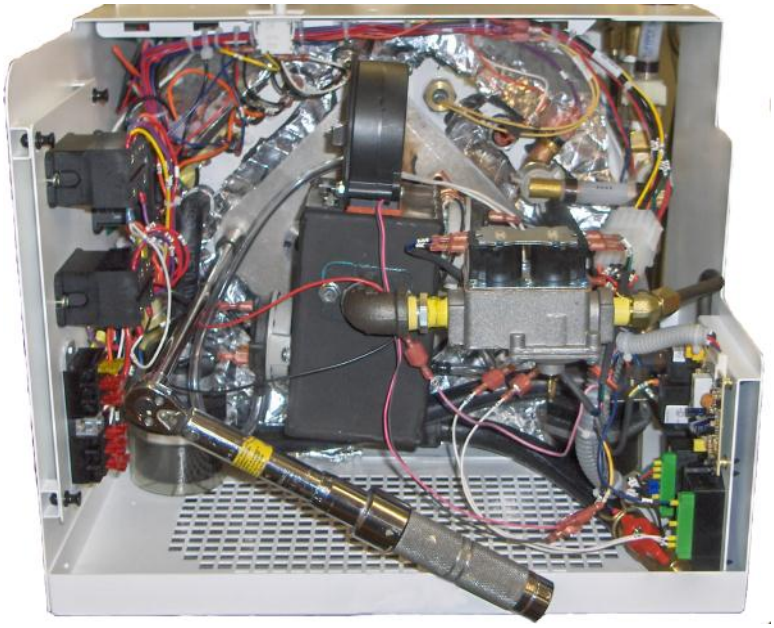
1. Align the Propane-Burner's front air-tube plate with the combustion chamber and slide onto the bolts protruding from the boiler tank.

Figure 48



2. Finger tighten all four nuts previously removed to secure the Propane-Burner to the boiler tank.

Figure 49



3. **Using a 9/16 socket wrench with a wobble extension, tighten the three nuts securely.**

Figure 50

Step 3: Reconnect the Fuel Line

1. **Connect the Supply Fuel Line to the Propane-Burner's Gas Valve Assembly.**
2. **Using an 11/16 wrench, tighten the nut on the fuel line to the Gas Valve Assembly to secure the line in place.**

Figure 51

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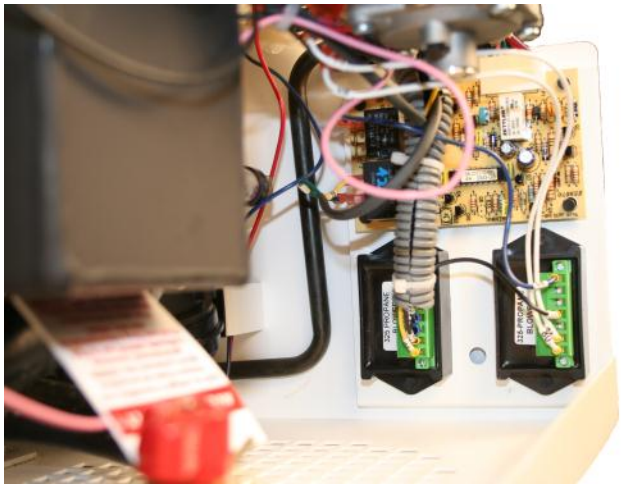
Step 4: Reconnect the Propane-Burner to the Propane-Burner Controller

1. **Connect the propane burner harness to the propane burner controller and buck boost converters. Remember to attach the 3 separate wires, previously disconnected from the propane burner controller.**
   - **A. Wire #r 86 connects to the PWR terminal.**
   - **B. Wire # 92 connects to the BLO terminal.**
   - **C. Wire # 82 connects to the HIS+ Terminal**

Figure 53



2. **Press firmly on connectors to secure them to the Propane Burner Controller. Secure the Buck Boost Converter plugs by screwing in the set screws, previously loosened.**

Figure 54

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Step 5: Reinstall the Access Cover

1. **Set the access cover back into place on the Aqua-Hot.**

Figure 55

2. **Insert the bolts in the two locations on the Aqua-Hot to secure the cover in place; tighten the bolts securely.**

NOTE: The access cover must be installed prior to operation as a safety switch exists, which will prevent the Aqua-Hot from operating whenever the access cover is not properly installed.

CAUTION!

Be sure to turn the Gas Valve, on top of the heater, ON, prior to starting the Propane-Burner. Failure to do so could result in a Propane-Burner malfunction.

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Mounting Gasket:

⚠ DANGER! ⚠

The Aqua-Hot operates on both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

Function:

The Mounting Gasket creates a tight seal between the Combustion Chamber and the Propane-Burner Mounting Plate.

Replacement Indicator:

The Mounting Gasket should be replaced each time the Propane-Burner is detached from the Aqua-Hot.

Replacement Procedure:

CAUTION:

Be sure to shut off the Fuel Supply line prior to beginning this replacement procedure.

1. Follow the "Detaching and Reattaching the Propane-Burner" procedure located in Section 7 of this manual.

2. Remove the existing Mounting Gasket from the Boiler Tank's front plate and from the Propane-Burner Mounting Plate. Be sure to clean the old gasket completely off of both plates

3. Set the replacement Mounting Gasket into place on the Boiler Tank's front plate.

4. Following the procedure for "Detaching and Reattaching the Propane-Burner," reattach the Propane-Burner to the Aqua-Hot.

CAUTION:

Be sure to open the shut-off valve for the Fuel Supply prior to starting the Propane-Burner.

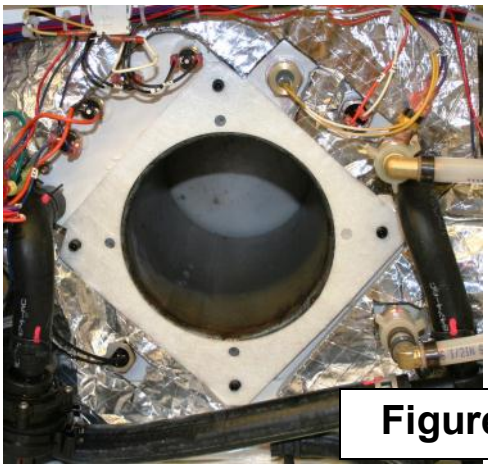

Figure 57

Hot Surface Igniter

⚠ DANGER! ⚠

The Aqua-Hot operates o both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

Function:

The Hot Surface Igniter ignites the propane fuel. It will activate 15 seconds after the initial start up process begins, and will be activated 5 seconds prior to the propane dual stage gas valve opening, to ensure it is up to the proper ignition temperature of 1300° F, before propane enters the burn chamber.

Replacement Indicator:

Replace the Hot Surface Igniter if:

1. It fails to ignite the propane fuel.
2. If it is cracked or damaged.

Troubleshooting

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

1. Turn the Propane-Burner switch to the ON position, on the interior Switch Panel.

2. After approximately 15 seconds, the Propane-Burner Controller will activate the Hot Surface Igniter.

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Hot Surface Igniter - (continued)

A. Check the Burner Controller for 12 VDC at the Hot Surface igniter wire, # 82. If no voltage exists follow the procedure for replacing the Propane Burner Controller

B. Check the Hot Surface Igniter Buck Boost for 12 VDC at wires #80 and #81. If no voltage is present follow the procedure for replacing the Buck Boost converter.

If voltage does exist:

C. Using a D.C. Clamp-on type amp meter. Test the Hot surface Igniter wires, #80 or #81, and see if the Hot Surface Igniter is pulling amps. It should pull approximately 2 amps. If the Hot surface Igniter is not pulling any amps follow the Hot Surface Igniter Replacement Procedure.

Visual Inspection Procedure

It is possible to view the Hot Surface Igniter, to verify functionality.

1. Turn the Propane-Burner switch to the OFF position, on the interior switch panel.

2. Close the Propane Gas Ball Valve, on the top of the heater, where the propane line connects to the heater.

3. Using a 7/64 Allen Wrench, loosen the Hot Surface Igniter and remove.

CAUTION:

The Hot Surface Igniter is extremely HOT, use caution when handling or serious burns may occur.

CAUTION:

Be careful not to drop or hit the Hot Surface Igniter or serious damage can occur to the Hot Surface Igniter's ceramic casing.

4. With the Hot Surface Igniter removed, and the Propane Gas Ball Valve closed, turn the Propane-Burner Switch, on the interior switch panel to the ON position.

5. After the 15 second prime cycle, the Propane Burner Controller will activate the Hot surface Igniter.

NOTE: The Hot Surface Igniter will be activated for 10 seconds before the Propane-Burner Controller deactivates it, due to a no flame condition.

6. After the Hot Surface Igniter is activated, watch the tip to make sure it gets glowing, red hot.

7. If the igniter does get glowing, red hot it is working properly. If it does not glow, follow the Hot Surface igniter replacement Procedure.

Replacement Procedure

⚠ DANGER! ⚠

The Aqua-Hot operates o both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

1. Turn the Propane-Burner Switch to the OFF position, on the switch panel inside the motor home.

2. Disconnect the wires by pulling firmly on the red quick disconnect fitting.

3. Using a 7/64 Allen Wrench, loosen the Hot Surface Igniter and remove.

CAUTION:

Be careful not to drop or hit the Hot Surface Igniter or serious damage can occur to the Hot Surface Igniter ceramic casing.

4. Install the replacement Hot Surface Igniter.

5. Using a 7/64 Allen Wrench, tighten the Hot Surface Igniter in place.

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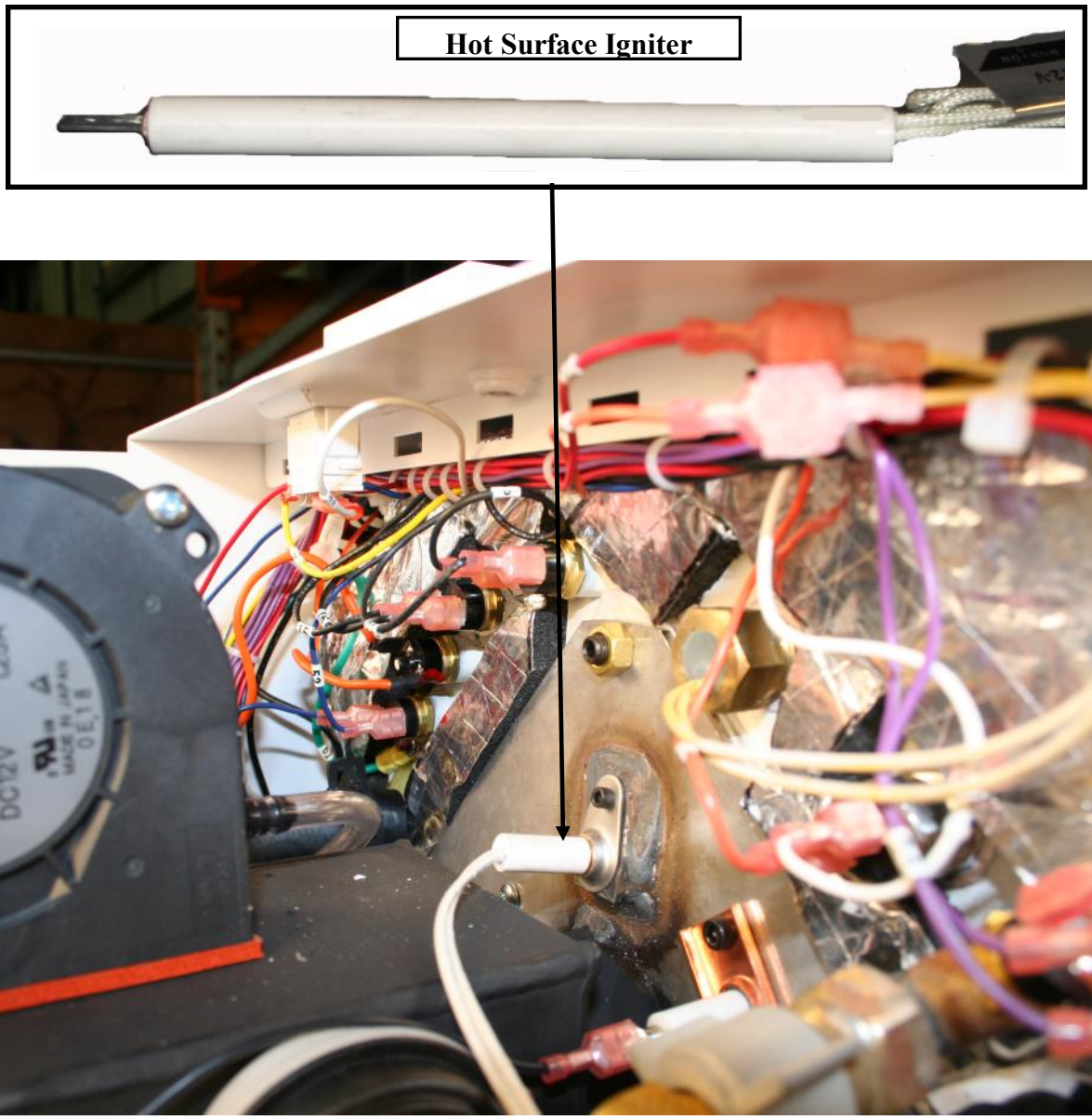
Hot Surface Igniter - (continued)

6. Reconnect the wires previously disconnected.

7. Test for proper operation.



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Refractory

⚠ DANGER! ⚠

The Aqua-Hot operates o both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

Function:

The Refractory acts as an insulator, to protect the hot surface igniter from being overheated by the flame. Troubleshoot the Refractory if the propane burner "POPS" on ignition, or if the propane burner fails to ignite.

Replacement Indicator:

Replace the Refractory if it becomes damaged

NOTE: Improper handling of the burner may cause the Refractory to shift it's position on the propane burner, causing it to cover the hot surface igniter. This will result in the propane fuel being ignited late, or not at all.

Troubleshooting

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

1. Follow the instructions for troubleshooting the Hot Surface Igniter.
2. If the Hot Surface Igniter is functioning properly follow the instructions for removing the Propane Burner.
3. With the Propane Burner removed ensure the Refractory is securely in place on the propane burner, seated against the Propane Burner mounting plate.

NOTE: If the Refractory is cracked or damaged, it will need to be replaced.

Replacement Procedure

1. Turn the Propane-Burner Switch to the OFF position, on the switch panel inside the motor home.
2. Turn the propane fuel supply valve, located on the top of the heater, to the OFF position.
3. Loosen and disconnect the propane fuel line, from the dual stage gas valve, on the propane burner.
4. Using a 9/16" socket, loosen and remove the four nuts, securing the propane burner to the heater.
5. Locate and remove the screws securing the defective refractory to the propane burner.
6. Locate and remove both the Hot Surface Igniter and the Flame Sensor.
7. Remove the defective refractory.
8. Install the replacement refractory onto the propane burner, ensuring both the flame sensor and hot surface igniter holes are aligned properly.
9. Reinstall both the Hot Surface Igniter and the Flame Sensor.
10. Secure the Refractory to the burner using the screw previously removed.
11. Reinstall the propane burner to the heater, and tighten the nuts securing the burner in place.
12. Connect the propane fuel line to the dual stage gas valve, and securely tighten.
13. Turn the propane fuel supply valve to the on position.
14. Test for proper operation.

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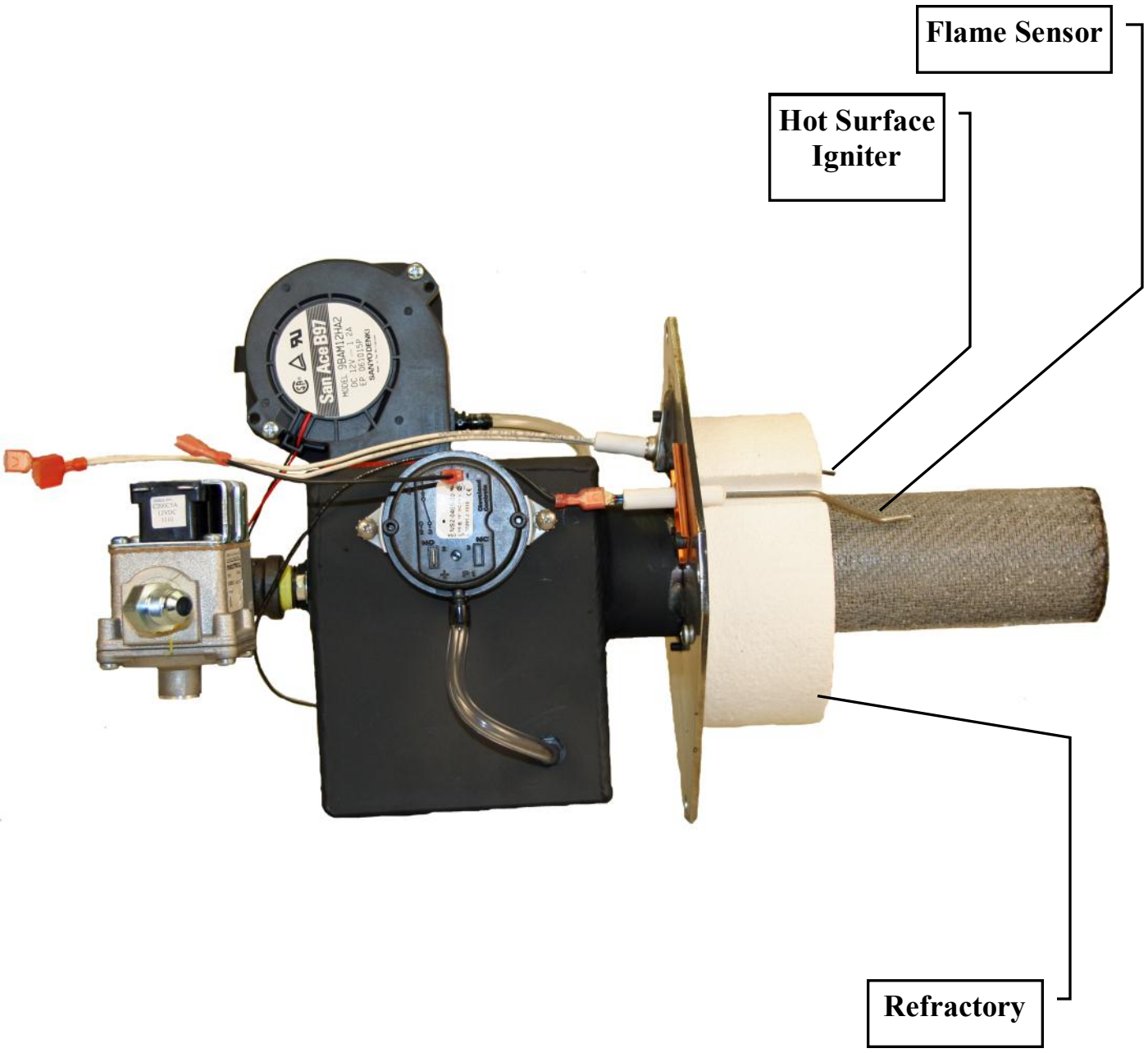
Refractory: (Continued)



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Dual Stage Propane Gas Valve

Function:

The Dual Stage Propane Gas Valve will activate approximately 6 seconds after the Hot Surface Igniter has been activated, to allow propane gas to enter the combustion chamber.

NOTE: Both Stages of the Dual Stage Propane Gas Valve must be activated before propane gas will flow into the combustion chamber.

Replacement Indicator:

Replace the Dual Stage Propane Gas Valve if either stage fails to open, Failing to allow propane gas to enter the combustion chamber.

NOTE: Before Troubleshooting the Dual Stage Propane Gas Valve, verify the coach has propane, and that all Propane shut off valves are in the open position.

Troubleshooting:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

1. Turn the Propane-Burner Switch, on the interior switch panel, to the ON position.

NOTE: After the 15 second Prime Cycle, and the 5 second Hot Surface Igniter Cycle the Propane-Burner should activate both stages of the Dual Stage Propane Gas Valve.

2. Once it has been determined that the Dual Stage Propane Gas Valve should be activated, verify that the Propane Burner Controller is sending 12 VDC to Both Stages of the Dual Stage Propane Gas Valve.

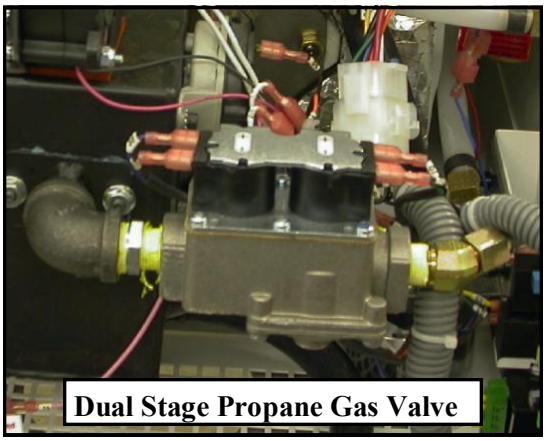
   A. Using a Digital Volt Meter, check the #87 (green) wire, on the White Plug, plugged into the Propane-Burner Controller for 12 VDC. If no voltage is present replace the Propane-Burner Controller.

3. Once it has been determined that the Propane-Burner Controller is sending power to the Dual Stage Propane Gas Valve, Verify 12 VDC at both sides of the Dual Stage Propane Gas Valve.

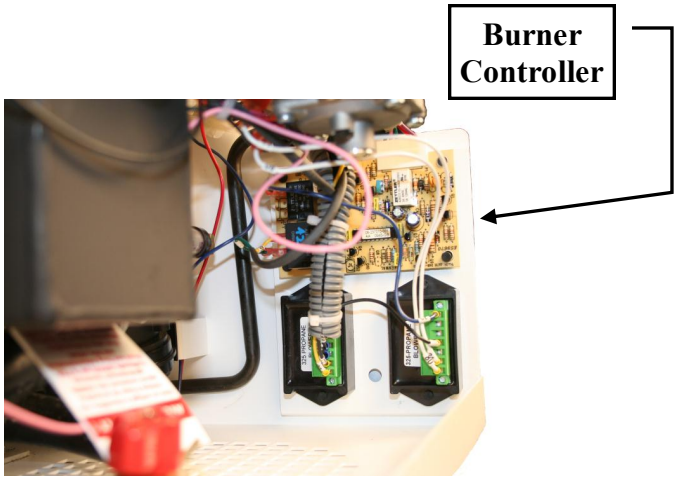
   A. Using a Digital Volt Meter, check the #87 (green) wire, on the right side of the gas valve for 12 VDC, and the #88 (blue) wire, on the left side of the gas valve for 12 VDC. If no voltage is present inspect wire harness for damage.

NOTE: The #87 (green) and the #88 (blue) wires are spliced together inside the Propane-Burner Harness, next to White Propane-Burner controller plug.

4. If both stages of the Dual Stage Propane Gas Valve are receiving 12 VDC, but either stage fails to open, the Dual Stage Propane Gas Valve must be replaced. Follow the Dual Stage Propane Gas Valve Replacement procedure in this section.



Dual Stage Propane Gas Valve



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CAUTION!

Be sure to turn OFF the Propane Fuel Supply, at the port on top of the Aqua-Hot prior to beginning this replacement procedure.

Dual Stage Propane Gas Valve (continued)

⚠ DANGER! ⚠

The Aqua-Hot operates o both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply from the Aqua -Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

Replacement Procedure:

1. Shut off the propane fuel supply, by turning the propane inlet port ball valve to the OFF position.

2. Using an 11/16 wrench, remove the propane supply line from the Dual Stage Propane Gas Valve.

3. Using a 1/2" Wrench, loosen and remove the dual stage propane gas valve from the propane burner.

NOTE: It may be necessary to use a back up wrench to prevent damage to the propane burner, when removing the dual stage gas valve.

4. Remove and clean the steel fittings on the defective dual stage gas valve, to use on the replacement dual stage gas valve.

5. Wrap the threads of the steel fittings with a thread sealant recommended for use with propane gas fittings.

6. Install the steel fittings onto the dual stage gas valve, as they were previously removed.

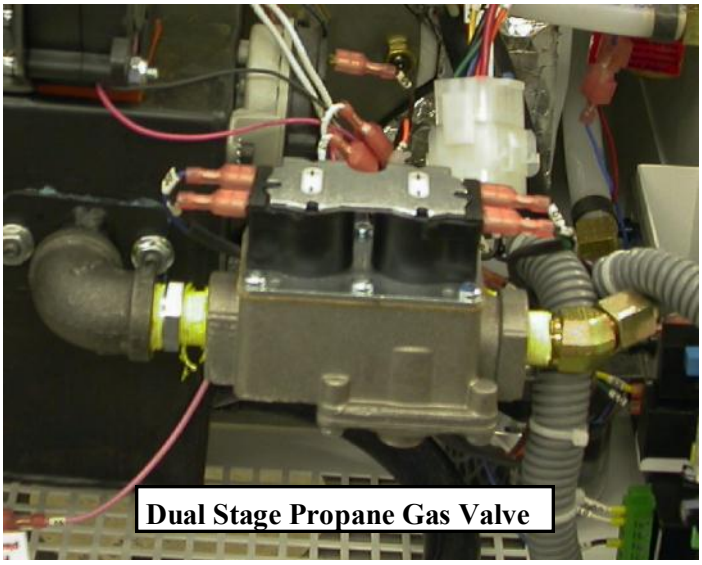
7. Connect the dual stage gas valve to the propane burner.

8. Connect the propane supply line to the dual stage gas valve.

9. Turn the Propane inlet port ball valve to the ON position.

10. Test for propane leaks.

11. Test for proper operation.



Dual Stage Propane Gas Valve

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Combustion Blower Fan

Function:

The Combustion Blower fan creates combustion air, which is blown into the combustion chamber to mix with the propane fuel, before it is ignited.

Replacement Indicator:

Replace the Combustion blower fan if it is damaged or not working.

Troubleshooting:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

1. Turn the Propane-Burner Switch to the ON position, on the Interior Switch Panel.

2. Verify the following:
   A. The control Thermostat is calling for heat.
   B. The interlock switch is not tripped.
   C. The float switch is not tripped.
   D. There is 12 VDC going to the Propane-Burner Controller.

3. Verify that the Propane-Burner Controller is sending power to the combustion blower motor.

   A. Using a digital Voltmeter check wire #92 (green) for 12 VDC, at the white plug, plugged into the Propane Burner Controller. If no voltage is present replace the Propane-Burner Controller.

4. If the Propane-Burner Controller is sending power out on wire #92 (green), verify that the right hi-limit thermostat is operating properly. Follow the troubleshooting guide for the Right D.C. Hi-Limit thermostat in section 4.

5. If the Right D.C. Hi-Limit thermostat is functioning properly, verify that the Buck Boost Converter for the Blower motor is operating properly.

   A. Using a digital volt meter check the #92 wire going into the Buck Boost Converter for 12 VDC. If there is no voltage inspect wire for loose connections or damage.

   B. If there is power going into the Buck Boost Converter on wire #92, check wire # 99 for 12 VDC exiting the Buck Boost Converter, going to the combustion blower fan.

If there is power going to the Combustion Blower Fan, but it still fails to operate, replace the Combustion Blower Fan.

Replacement Procedure:

1. Turn the Propane-Burner Switch to the OFF position on the Interior Switch Panel, inside the motor home.

2. Disconnect the wires, connecting the combustion blower fan to the harness.

3. Using a 3/8” socket, loosen the nuts securing the combustion blower fan to the propane burner. Reference figure ?.

4. Discard the gasket sealing the combustion blower fan to the propane burner.

5. Using a Phillips head screwdriver, and a 9mm socket, remove the air shutter assembly from the defective combustion blower fan. Reference Figure ?.

6. Using a Phillips head screwdriver and a 9mm socket, install the Air shutter assembly onto the replacement combustion blower fan. Torque = 12 in/lbs.

7. Replace discard gasket with a new replacement gasket.

8. Using a 3/8” socket. Secure the combustion blower fan assembly to the propane burner. Torque = 35 in/lbs.

9. Reconnect the wires, previously disconnected.

10. Test for proper operation.

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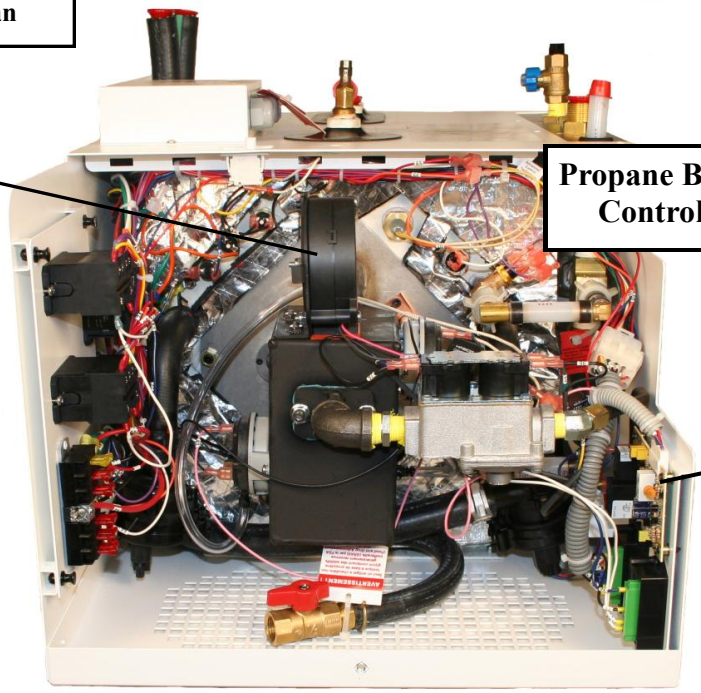
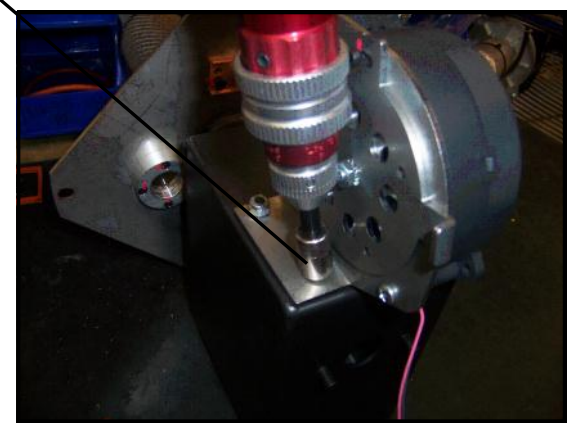
Gasket

Combustion Blower Fan



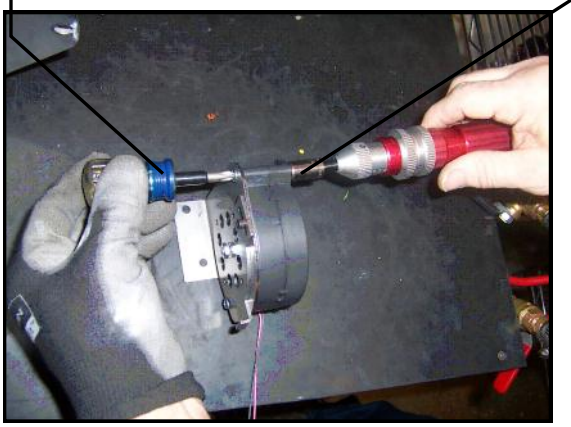
Propane Burner Controller

3/8" Socket



Phillips Screwdriver

9mm Socket



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Exhaust "High Back Pressure" Switch

Function:

The purpose of the Exhaust "High Back Pressure" Switch, is to monitor back pressure inside the combustion chamber, and shut the burner down if it senses high back pressure. It is normally closed, and if it senses high back pressure it will trip and will interrupt the Flame Sensor signal, shutting down the propane burner.

Replacement Indicator:

Replace the Exhaust "High Back Pressure" Switch if it fails to operate properly or is damaged.

Troubleshooting Procedure:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this trouble-shooting procedure.

1. Turn the Propane-Burner Switch, on the interior switch panel to the OFF position, and let the Propane-Burner completely shut down.

2. Located the Exhaust "High Back Pressure" Switch, on the left side of Propane Burner.

3. Disconnect the two wires, connected to the switch, by firmly pulling on the quick disconnect terminals.

4. Using a Digital Voltmeter, check the Exhaust "High Back Pressure" Switch for continuity.

   A. If no continuity exists replace the Exhaust "High Back Pressure" Switch.

   B. If there is continuity while the propane burner is off, inspect exhaust for signs of damage, that may cause back pressure into the exhaust chamber.

NOTE: Before Replacing the High Back Pressure Switch, it is recommended to inspect the exhaust pipe for damage or restrictions.

Replacement Procedure:

1. Disconnect the two wires, connected to the switch, by firmly pulling on the quick disconnect terminals.

2. Using a 5/32" Allen Wrench, loosen the two screws, securing the switch to the left side of the propane burner.

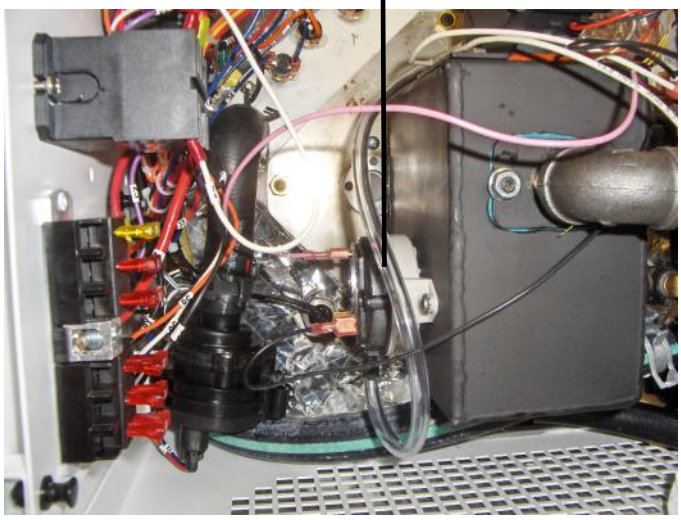
3. Remove the defective switch.

4. Secure the replacement switch to the side of the propane burner, using the screws previously removed.

5. Reconnect the wires, previously removed from the defective switch.

6. Test for proper operation.

Exhaust "High Back Pressure" switch



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Fan Validation Switch

Function:

The purpose of the Fan Validation Switch, is to monitor the combustion blower fan, and verify that it is operating properly. The Fan Validation Switch is normally open.

Replacement Indicator:

Replace the Fan Validation Switch if it fails to operate properly or is damaged.

Troubleshooting Procedure:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

1. Turn the Propane-Burner Switch, on the interior switch panel to the OFF position, and let the Propane-Burner completely shut down.

2. Locate the Fan Validation Switch, on the right side of Propane Burner.

3. Disconnect the two wires, connected to the switch, by firmly pulling on the quick disconnect terminals.

4. Using a Digital Voltmeter, check the fan validation switch for continuity.

   A. If continuity exists when the combustion blower fan is NOT running replace the fan validation switch.

   B. If there is no continuity while the propane burner is off, Turn the Propane Burner to the ON position, and verify that the combustion blower fan is running.

   C. With the combustion blower fan running, using a digital voltmeter and re-check the fan validation switch for continuity .

      i. If there is continuity, with the combustion blower fan running the fan validation switch is operating properly.
      ii. If there is no continuity, with the combustion blower fan running, the fan validation switch is defective and will need to be replaced.

Replacement Procedure:

1. Disconnect the two wires, connected to the fan validation switch, by firmly pulling on the quick disconnect terminals.

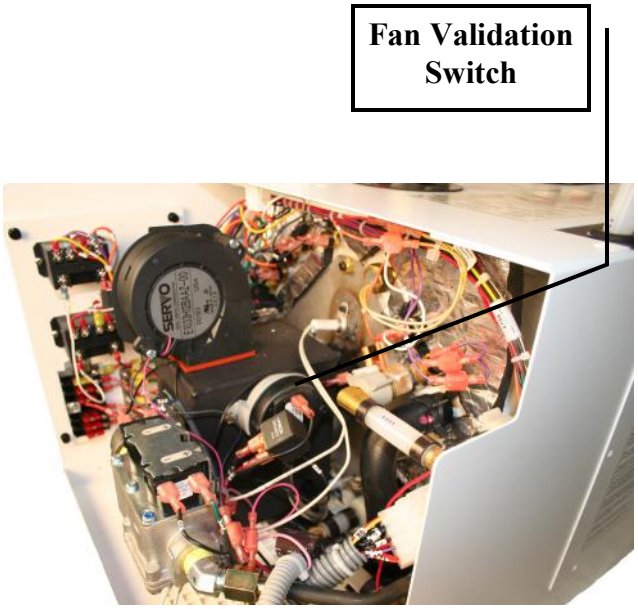
2. Using a 5/32” Allen Wrench, loosen the two screws, securing the fan validation switch to the Right side of the propane burner.

3. Remove the defective fan validation switch.

4. Secure the replacement fan validation switch to the side of the propane burner, using the screws previously removed.

5. Reconnect the wires, previously removed from the defective fan validation switch.

6. Test for proper operation.



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Fan Validation Switch Relay

Function:

The purpose of the Fan Validation Switch Relay , is to reduce the amount of amps going to the Fan Validation Switch. It takes the normal .5 amps and reduces it to .1 amps, to extend the life of the Fan Validation Switch.

Replacement Indicator:

Replace the Fan Validation Switch Relay if it fails to operate properly or is damaged.

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this trouble-shooting procedure.

Troubleshooting Procedure:

1. Turn the Propane-Burner Switch, on the interior switch panel to the OFF position, and let the Propane-Burner completely shut down.

2. Locate the Fan Validation Switch Relay, on the right side of Propane Burner.

3. Disconnect the two wires, #84 & #91, connected to the relay, by firmly pulling on the quick disconnect terminals.

4. Using a Digital Voltmeter, check the fan validation switch Relay for continuity.

   A. If continuity exists when the combustion blower fan is NOT running replace the fan validation switch Relay.

   B. If there is no continuity while the propane burner is off, Turn the Propane Burner to the ON position, and verify that the combustion blower fan is running.

   C. With the combustion blower fan running, using a digital voltmeter and re-check the fan validation switch relay for continuity .

      i. If there is continuity, with the combustion blower fan running the fan validation switch is operating properly.
      ii. If there is no continuity, with the combustion blower fan running, the fan validation switch is defective and will need to be replaced.

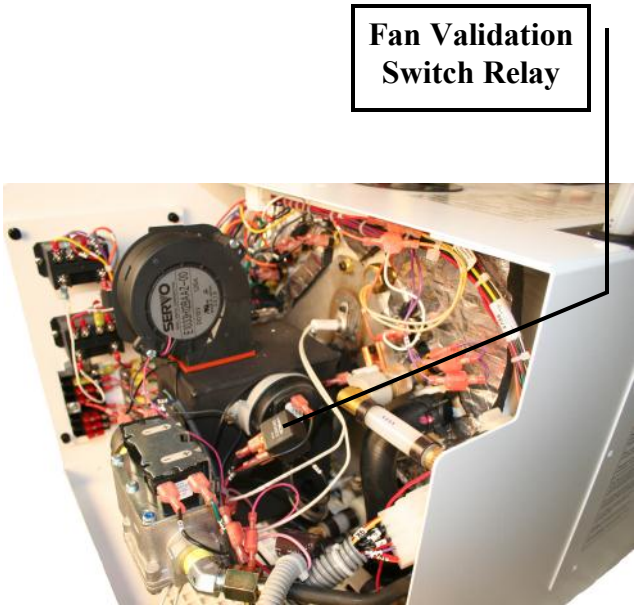
Replacement Procedure:

1. Locate the Fan Validation Switch Relay.

2. Disconnect the wires connected to the Fan Validation Switch Relay. Note the location of each wire.

3. Reconnect the wires to the new Fan Validation Switch Relay, refer to the wiring diagram in appendix A for proper placement of the wires on the relay.

4. Test for proper operation



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Buck Boost Converter - Combustion Blower Fan

Function:

The purpose of the Buck Boost Converter is to maintain a preset output voltage,

NOTE: There are two different Buck Boost Converters. One is for the Combustion Blower Fan, and the other one is for the Hot Surface Igniter.

Replacement Indicator:

Replace the Buck Boost Converter if it fails to operate properly or is damaged.

Troubleshooting Procedure:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this trouble-shooting procedure.

1. Turn the Propane-Burner Switch to the ON position, on the Interior Switch Panel.

2. Verify the following:
   A. The control Thermostat is calling for heat.
   B. The interlock switch is not tripped.
   C. The float switch is not tripped.
   D. There is 12 VDC going to the Propane-Burner Controller.

3. Verify that the Propane-Burner Controller is sending power to the Buck Boost Converter at the BLO pin, on the controller.

   A. If the propane burner controller is not sending a power signal to the buck boost converter, replace the propane burner controller.

4. Verify that the Propane Burner Controller is sending a ground signal to the buck boost converter at the GND pin, on the Controller

   B. If the propane burner controller is not sending a ground signal to the buck boost converter, replace the propane burner controller.

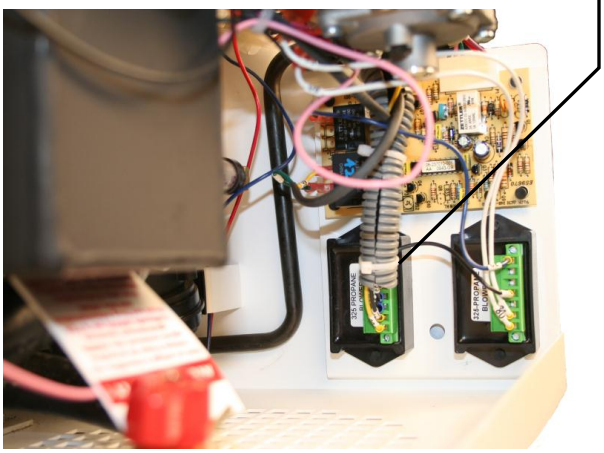
5. If the propane Burner Controller is sending power and ground to the buck boost converter, verify that the buck boost converter is receiving the power and ground signals. Through the individual wires. The power wire is #92, the ground wire is #95.

   A. If an individual wire is not sending the proper signal, replace that individual wire.

6. Verify that the buck boost converter is sending power and ground to the combustion blower motor, wire #99 is the power wire, and wire #98 is the ground. This voltage should be approximate 12.5 VDC, when the supply voltage is between 11 VDC - 15 VDC.

   A. If the voltage going to the motor, from the buck boost converter is not 12.5 VDC, when the supply voltage is between 11 VDC - 15 VDC replace the buck boost converter.

Combustion Blower Fan Buck Boost Converter



Buck Boost Converter - Hot Surface Igniter

Function:

The purpose of the Buck Boost Converter is to maintain a preset output voltage,

NOTE: There are two different Buck Boost Converters. One is for the Combustion Blower Fan, and the other one is for the Hot Surface Igniter.

Replacement Indicator:

Replace the Buck Boost Converter if it fails to operate properly or is damaged.

Troubleshooting Procedure:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this trouble-shooting procedure.

1. Turn the Propane-Burner Switch to the ON position, on the Interior Switch Panel.

2. Verify the following:
   A. The control Thermostat is calling for heat.
   B. The interlock switch is not tripped.
   C. The float switch is not tripped.
   D. There is 12 VDC going to the Propane-Burner Controller.

3. Verify that the Propane-Burner Controller is sending power to the Buck Boost Converter at the HSI pin, on the controller.

   A. If the propane burner controller is not sending a power signal to the buck boost converter, replace the propane burner controller.

4. Verify that the Propane Burner Controller is sending a ground signal to the buck boost converter at the GND pin, on the Controller

NOTE: The Propane Burner Controller sends a GND signal out on wire #95. Wire #95 then goes to the combustion blower fan's buck boost, and is tied into Wire #11, which is the ground wire for the Hot Surface Igniter's buck Boost.

   B. If the propane burner controller is not sending a ground signal to the buck boost converter, replace the propane burner controller.

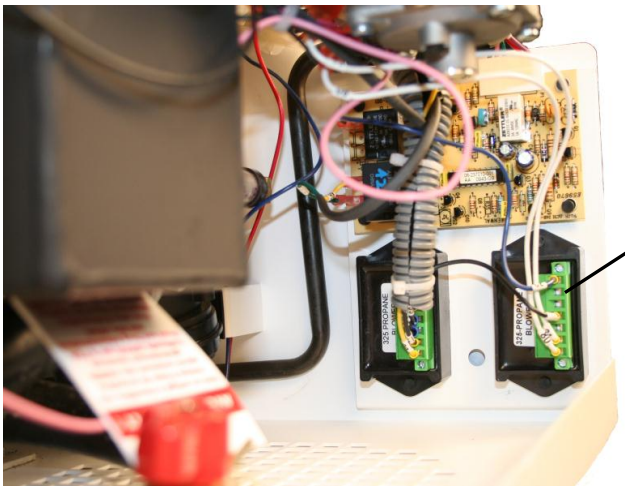
5. If the propane Burner Controller is sending power and ground to the buck boost converter, verify that the buck boost converter is receiving the power and ground signals. Through the individual wires. The power wire is #82, the ground wire is #11.

   A. If an individual wire is not sending the proper signal, replace that individual wire.

6. Verify that the buck boost converter is sending the proper power and ground signals to the hot surface igniter, wire #80 is the power wire, and wire #81 is the ground wire. This voltage should be approximate 12.5 VDC, when the supply voltage is between 11 VDC - 15 VDC.

   A. If the voltage going to the motor, from the buck boost converter is not 12.5 VDC, when the supply voltage is between 11 VDC - 15 VDC replace the buck boost converter.

Hot Surface Igniter Buck Boost Converter



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Flame Sensor

Function:

The purpose of the Flame Sensor, is to monitor the flame of the propane burner and verify that it is burning properly. The flame sensor turns the heat from the flame into a mili-volt signal that the propane burner controller senses.

Replacement Indicator:

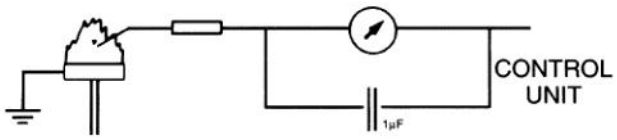
Replace the Flame Sensor if it fails to operate properly or is damaged.

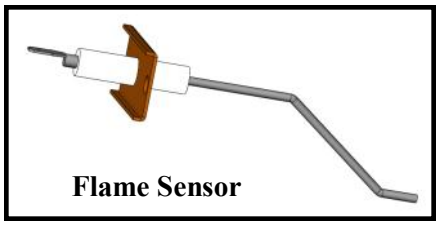
Troubleshooting Procedure:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

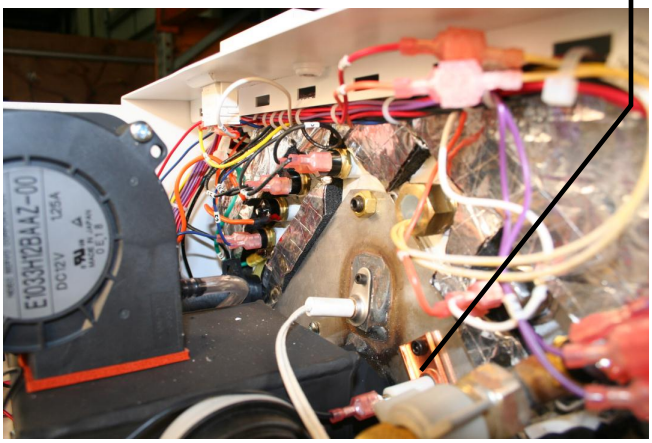
1. Flame current is the current which passes through the flame from the sensor to ground to complete the primary safety circuit. The minimum flame current necessary to keep the system from lockout is 0.7µA microamps. To measure flame current, DISCONNECT INPUT VOLTAGE, then insert a 0-50µA DC meter and capacitor in series with the sensor electrode and wire per Figure 5. Meter should read 0.7µA or higher while flame is established. If meter reads below "0" on scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.

System Flame Current Measurement Circuit





Flame Sensor



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Fenwal Burner Controller

Function:
When a call for heat is received from the control thermostat supplying 12 volts to PWR, the controller will reset, perform a self check routine, and a pre-purge delay begins. Following the pre-purge period the gas valve is energized and the hot surface igniter will commence for the trial for ignition period.

When flame is detected during the trial for ignition, the hot surface igniter is shut off immediately and the gas valve remains energized. The thermostat and main burner flame are constantly monitored to assure the system continues to operate properly. When the thermostat is satisfied and the demand for heat ends, the main valve is de-energized immediately.

Replacement Indicator:

Replace the Propane Burner Controller if it fails to operate properly or is damaged.

Troubleshooting Procedure:

NOTE: The interlock switch will prevent the Propane-Burner from operating without the access cover intact; therefore, the switch will need to be manually pressed during this troubleshooting procedure.

Failure to Light - Lockout

1. Should the Propane Burner fail to light, or the flame is not detected during the first trial for ignition period, the gas valve is de-energized and the control goes through an inter-purge delay before another ignition attempt. The controller will attempt two additional trials before going into lockout and the valve relay will be de-energized immediately.

NOTE: Recover from lockout requires a manual reset by removing 12 VDC for a period of 5 seconds.

Flame Failure - Re-Ignition

1. If the established flame signal is lost while the burner is operating, the control will respond within 0.8 seconds. The Hot Surface Igniter will be energized for a trial for ignition period in an attempt to relight the burner. If the burner does not light, the controller will de-energize the gas valve. The controller will make two more attempts to relight the burner. If the burner does no relight, the control will go into lockout as noted above in "Failure to Light". If the flame is re-established, normal operation resumes.

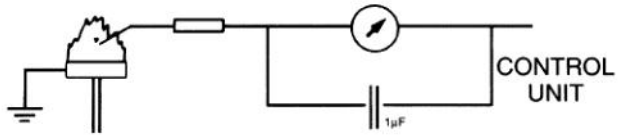
Flame Current Check

1. Flame current is the current which passes through the flame from the sensor to ground to complete the primary safety circuit. The minimum flame current necessary to keep the system from lockout is 0.7µA microamps. To measure flame current, DISCONNECT INPUT VOLTAGE, then insert a 0-50µA DC meter and capacitor in series with the sensor electrode and wire per Figure 5. Meter should read 0.7µA or higher while flame is established. If meter reads below "0" on scale, meter leads are reversed. Disconnect power and reconnect meter leads for proper polarity.

WARNING!

When monitoring flame current, use a 1.5µF \by pass capacitor to protect the meter from damage.

System Flame Current Measurement Circuit



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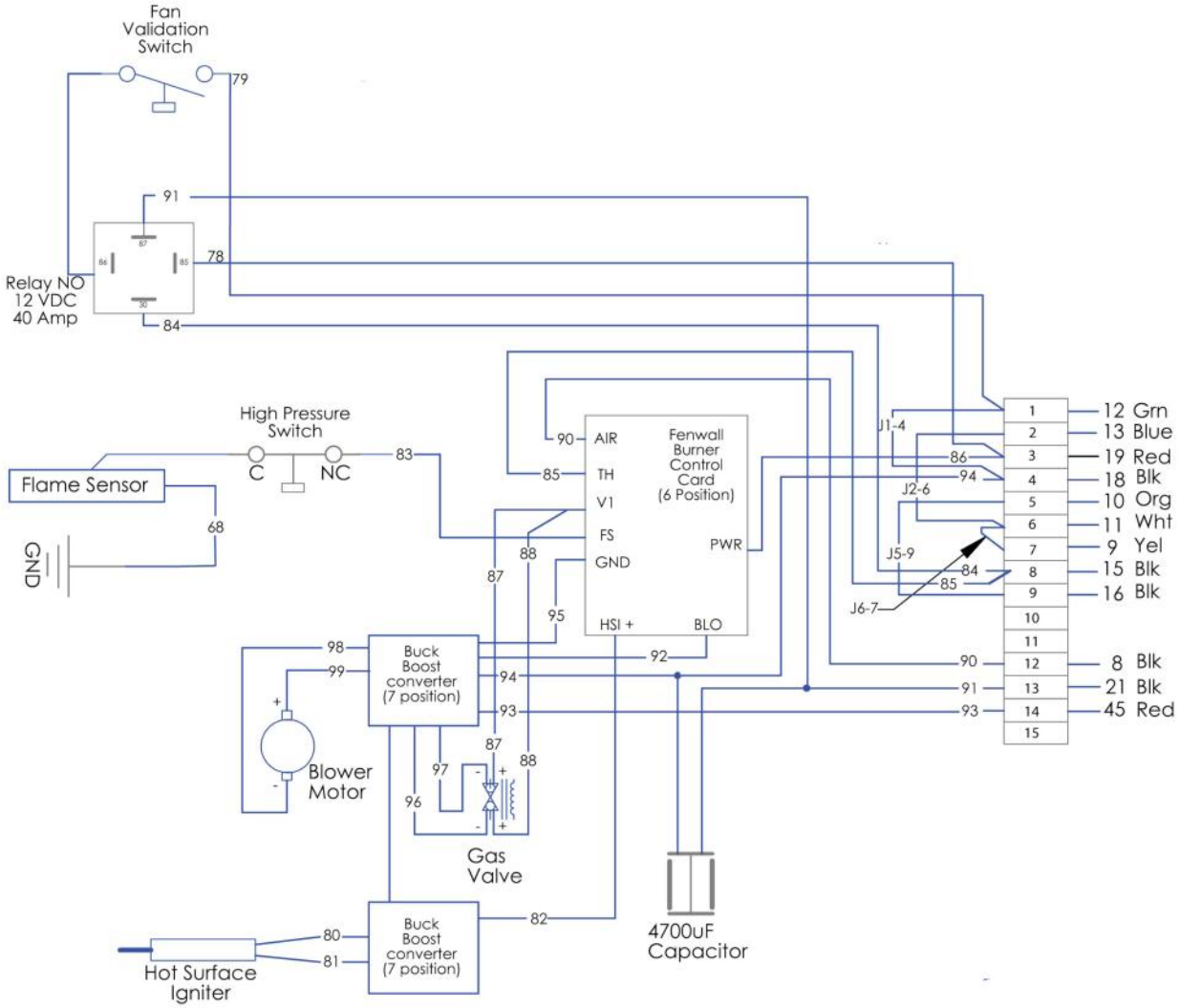
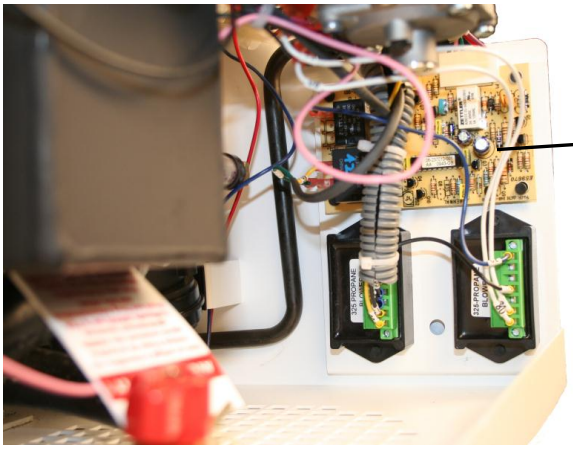
Fenwal Burner Controller



Fenwal Burner Controller



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Fenwal Burner Controller

SPECIFICATIONS

Input Power	Control: 9.5 to 15 VDC from a storage battery or full wave rectified unfiltered 50/60 Hz AC
Input Current Drain	200 mA @ 12 VDC, gas valve relay energized(control only)
Gas Valve Rating	1.0A @ 12 VDC
Operating Temperature	-40°F to +167°F -40°C to +75°C
Flame Sensitivity	0.7µA minimum
Flame Failure Response Time	0.8 seconds maximum
Types of Gases	Natural, LP, or manufactured
Size (LxWxH)	4.00 x 2.30 x 1.50 inches 10.16 x 5.84 x 3.81 cm
Weight	3.0 ounces nominal (85 grams), uncovered version
Enclosure	Uncovered with integral standoffs or Potted Module
Moisture Resistance (Uncovered)	Conformal coated to operate to 95% R.H. Care must be taken to protect module from direct exposure to water
Tries for Ignition	One or three try versions available
Trial for Ignition Periods	5.0, 7.0, 10.0, or 25.0 seconds available
Prepurge & Interpurge Timings	None, 15 or 25 seconds depending on model. Without prepurge there is a 1 second safe start delay before the first try for ignition

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This troubleshooting section has been separated into various Aqua-Hot troubleshooting scenarios, which may be experienced by the heater. This troubleshooting section will begin with the most probable cause of failure and the corresponding remedy and will advance to the least probable cause and remedy in order to expedite the troubleshooting process and pinpoint the problem quickly. If additional assistance is needed, please contact the Aqua-Hot Heating Systems Technical Support Department by phone at 1-800-685-4298 (Monday through Friday, 7:00 AM to 4:00 PM Mountain Standard Time) or through Aqua-Hot Heating Systems' website by going to www.aquahot.com and clicking on the "Contact Us" link, then filling out the contact information for submittal.

WARNING!

The Aqua-Hot operates on both AC and DC power. Be sure to disconnect the 120 Volt-AC power supply from the Aqua-Hot prior to servicing. Failure to do so could result in serious personal injury, electrical shock, or even death!

NOTE: Be sure to check the Interior Switch Panel's Diesel-Burner switch for a blinking fault code prior to completing the following troubleshooting procedures.

NOTE: Please note that, due to the Interlock Safety Switch, the Aqua-Hot will not operate if the access cover is removed.

The Propane-Burner switch has been turned on; however, the Propane-burner fails to operate:

1. Is the Propane-Burner switch's indicator light illuminated?

A. NO

- **a.** Check for 12-Volt power at the B-fuse on the fuse block - does it exist?
- **c.** Test the float switch for functionality.
- **d.** Check the Propane-Burner switch for functionality.
- **e**. Check the Interlock switch for functionality.

B. YES

- **b.** Check the Control Thermostat (The Aqua-Hot's normal operating range is 160-190°F) for functionality by locating the control thermostat on the heater, disconnecting the wires and placing a jumper wire on the harness between wires #10 & #11.
- **e.** Check the Propane-Burner Controller for functionality.
- **f.** Check the Propane-Burner's Blower Motor for functionality by placing a direct power and ground source to the motor and checking for operation.

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The Propane-Burner switch has been turned on, and the Propane-burner's Blower Motor has begun to operate; however, the Propane-burner does not ignite:

1. Test both of the Propane-Burner's High-Limit Thermostats for continuity; if continuity does not exist, press the reset button on the High-Limit Thermostat.
2. Check the vehicle's fuel supply to ensure that an adequate amount of fuel exists.
3. Check the Propane Burner's High back Pressure Switch for proper functionality
4. Check the Propane-Burner's Hot Surface Igniter for proper functionality.
5. Check the Propane-Burner's Flame Sensor for proper functionality
6. Check the Propane-Burner's Dual Stage Gas Valve for Proper functionality

The Propane-Burner switch has been turned on; however, multiple attempts are required before the Propane-burner will ignite:

1. Check the Propane-Burner's Hot surface Igniter for proper functionality.
2. Check The Flame Sensor.

The Aqua-Hot's exhaust system "Woofs/Pops" when the Propane-burner is ignites:

1. Check The Propane-Burner's Hot surface Igniter for proper functionality.

The Propane-burner will ignite, but short cycles (only runs for a short amount of time before shutting down)

1. Check The Propane-Burner's control thermostat for proper functionality.
2. Check the Propane-Burner's Flame Sensor for proper functionality
3. Check the Propane-Burner's High Back Pressure Switch for proper functionality
4. Verify the exhaust pipe is not damaged or plugged, which would cause high back pressure.
5. Verify the Exhaust Tip has been properly installed.

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The Aqua-Hot is operating, but an interior and/or fresh water tank heating zone is not working.

1. Is the Low Temp Cutoff Thermostat Tripped?
   A. Unhook Thermostat Wires and using a volt meter, check thermostat for continuity.
2. Verify that the heat exchangers in that zone are working.
3. Check for loose wires.
4. Ensure that the check valve is not stuck in a closed position.
5. While the circulation pump is running, place hand on lines to check for the presence of hot antifreeze and water heating solution.
6. Is the Zone Relay functioning properly?
7. Is the Room Thermostat signaling the Aqua-Hot heater?

The Aqua-Hot is at operating temperature; however, the interior and/or fresh water tank heat exchanger fans are not operating:

1. When each particular zone's room thermostat is turned on, does the corresponding relay activate?
2. Is the Low Temp Cutoff Thermostat tripped?
   A. Unhook Thermostat Wires and using a volt meter, check thermostat for continuity.
3. Check for power at the relay for the fans, Pin (8).
4. Check the heat exchanger for loose wires.
5. Using a voltmeter, check for 12-Volts at the malfunctioning fan.
6. If applicable, is the switch for the fan on?

The Aqua-Hot is operating, but the domestic hot water system is not producing hot water.

1. Reference Section 1, pages 13-14, and ensure that the Aqua-Hot is using the appropriate antifreeze type and mixture ratio.
2. Verify that the water outlet's domestic hot water flow rate is at or below 1.5 Gallons per Minute (GPM).
3. Verify that the outside water faucet is turned off.
4. Is the propane-burner operating?
5. Verify that the tempering valve is properly adjusted. Temperature of water coming out of hot water faucet should be between 115° F - 123° F.
6. Ensure that the Low-Temp Cut-Off Thermostat is operating properly.
7. Ensure that the Boiler Tank's Stir Pump is operating.
8. Check Temperature of the cold water coming in.
9. Make sure the heater has not been bypassed.

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The Electric Element switch has been turned on; however, the Aqua-Hot's 120 volt-ac electric heating element does not operate (i.e., lack of hot water and/or interior heat):

> **NOTE:** The Aqua-Hot is not designed to provide continuous hot water using the Electric Heating Element only.

1. Ensure that the motor home is plugged into shore power or has the generator running.
2. Ensure the Aqua-hot is not up to maximum operating temperature, by checking it with a digital thermometer.
3. With the Interior Switch Panel's Electric Element switch on, locate the Electric Element's 120VAC relay and check for DC voltage at Pin #0 (+) and Pin #1 (-); reference Appendix A.
4. Ensure that the 12 Volt switch is turned on and that the relay engages.
5. Test the VAC Relay to ensure that it is working properly, using extreme caution.

   A. With the Electric Element switch on, check for AC voltage at both VAC power supply terminals on the relay (terminals #4 and #2).
   B. Inspect the VAC Relay and the Relay's wires for damage.
   C. Turn the VAC Breaker off and disconnect both VAC power supply wires from the VAC Relay terminals. Turn the Electric Element switch on and off while checking for continuity across the two open terminals on the VAC Relay. If no continuity exists, replace the VAC Relay.

6. Check the Electric Heating Element's High-Limit Thermostat for continuity; if no continuity, press the reset button on the thermostat.

7. Verify that the 120 Volt-AC Electrical Heating Element is operating properly.

   A. Disconnect the motor home from VAC shore power and switch off the motor home's generator.
   B. Detach and remove the propane-Burner.
   C. Check the Electric Heating Element for continuity. If no continuity, replace the Electric Heating Element.

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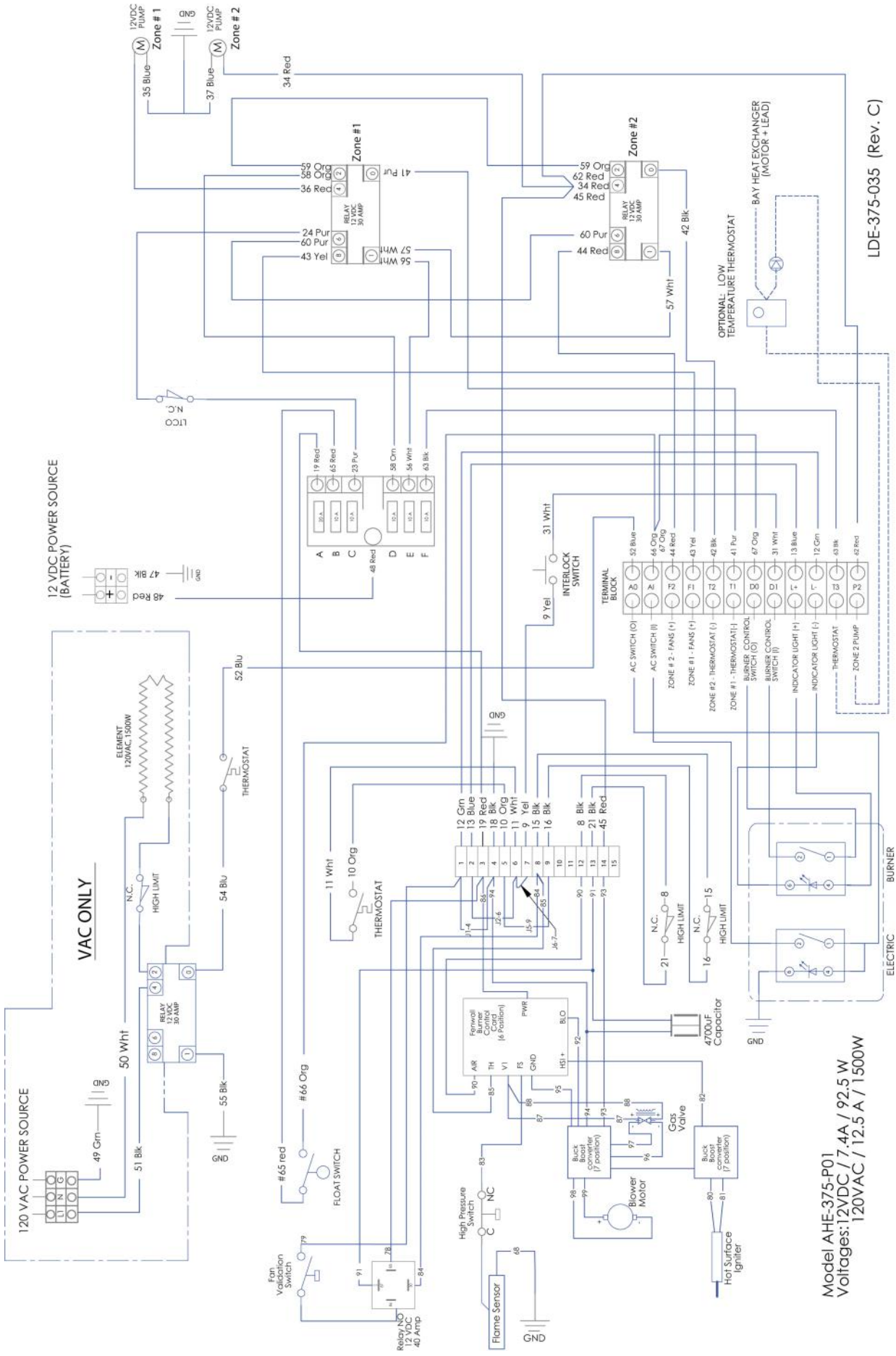
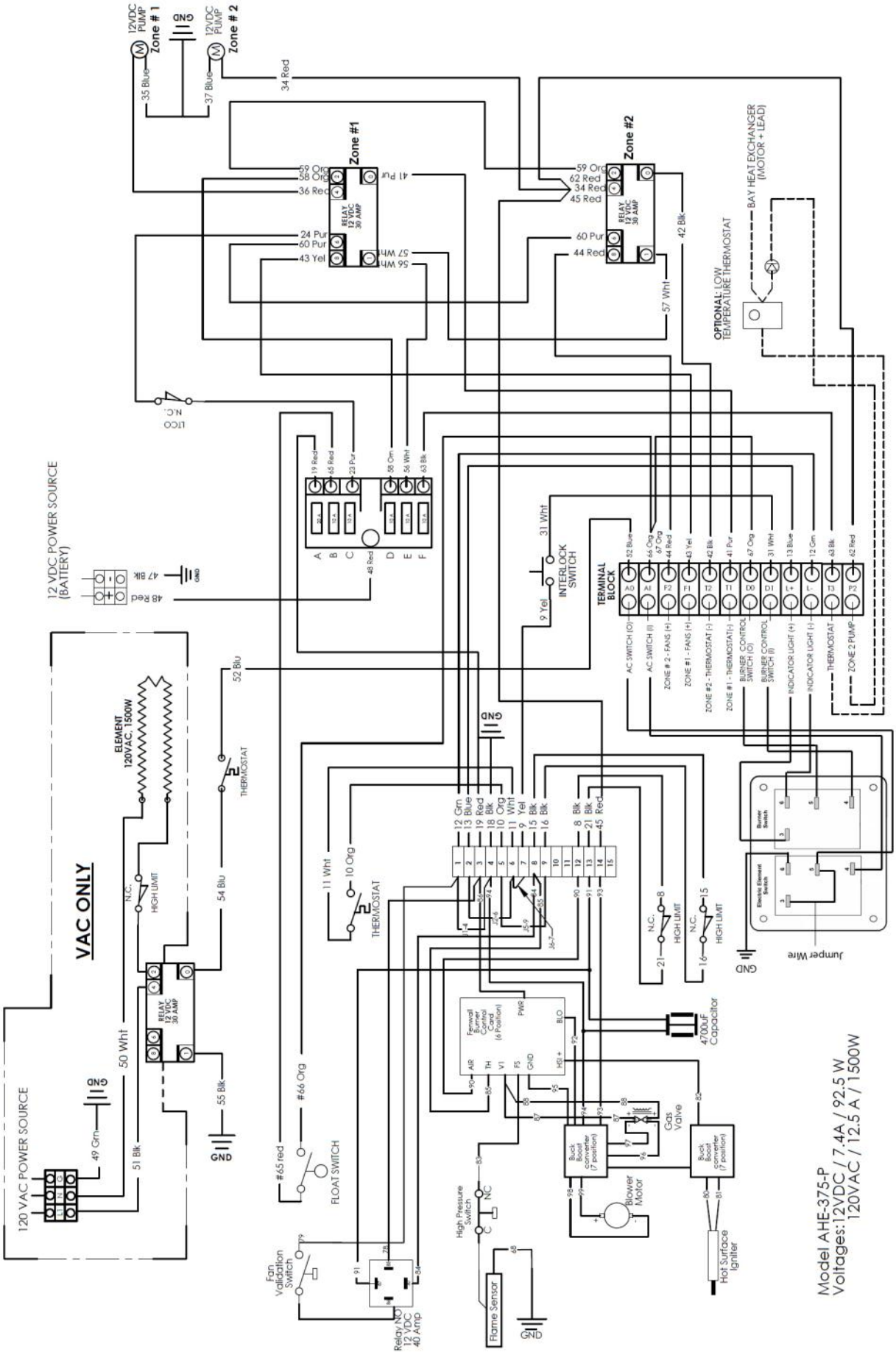
APPENDIX A: WIRING DIAGRAM - FOR UNITS MANUFACTURED BEFORE JANUARY 2011



APPENDIX A: WIRING DIAGRAM - FOR UNITS MANUFACTURED AFTER JANUARY 2011



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AMERICAN BOAT AND YACHT COUNCIL RECOMMENDATIONS

CONDUCTORS SIZES FOR 3% DROP IN VOLTAGE

TOTAL CURRENT ON CIRCUIT IN AMPS.	Length of Conductor from Source of Current to Device and back to Source—Feet																		
	10	15	20	25	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
12 Volts - 3% Drop Wire Sizes (gage) - Based on Minimum CM Area																			
5	18	16	14	12	12	10	10	10	8	8	8	6	6	6	6	6	6	6	6
10	14	12	10	10	10	8	6	6	6	6	4	4	4	4	2	2	2	2	2
15	12	10	10	8	8	6	6	6	4	4	2	2	2	2	2	1	1	1	1
20	10	10	8	6	6	6	4	4	2	2	2	2	1	1	1	0	0	0	2/0
25	10	8	6	6	6	4	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	3/0
30	10	8	6	6	4	4	2	2	1	1	0	0	0	2/0	2/0	3/0	3/0	3/0	3/0
40	8	6	6	4	4	2	2	1	0	0	2/0	2/0	3/0	3/0	3/0	4/0	4/0	4/0	4/0
50	6	6	4	4	2	2	1	0	2/0	2/0	3/0	3/0	4/0	4/0	4/0				
60	6	4	4	2	2	1	0	2/0	3/0	3/0	4/0	4/0	4/0						
70	6	4	2	2	1	0	2/0	3/0	3/0	4/0	4/0								
80	6	4	2	2	1	0	3/0	3/0	4/0	4/0									
90	4	2	2	1	0	2/0	3/0	4/0	4/0										
100	4	2	2	1	0	2/0	3/0	4/0											

24 Volts - 3% Drop Wire Sizes (gage) - Based on mInimum CM Area																			
5	18	18	18	16	16	14	12	12	12	10	10	10	10	10	8	8	8	8	8
10	18	16	14	12	12	10	10	10	8	8	8	6	6	6	6	6	6	6	6
15	16	14	12	12	10	10	8	8	6	6	6	6	6	4	4	4	4	4	2
20	14	12	10	10	10	8	6	6	6	6	4	4	4	4	2	2	2	2	2
25	12	12	10	10	8	6	6	6	4	4	4	4	2	2	2	2	2	2	1
30	12	10	10	8	8	6	6	4	4	4	2	2	2	2	2	1	1	1	1
40	10	10	8	6	6	6	4	4	2	2	2	2	1	1	1	0	0	0	2/0
50	10	8	6	6	6	4	4	2	2	2	1	1	0	0	0	2/0	2/0	2/0	2/0
60	10	8	6	6	4	4	2	2	1	1	0	0	0	2/0	2/0	3/0	3/0	3/0	3/0
70	8	6	6	4	4	2	2	1	1	0	0	2/0	2/0	3/0	3/0	3/0	3/0	4/0	4/0
80	8	6	6	4	4	2	2	1	0	0	2/0	2/0	3/0	3/0	3/0	4/0	4/0	4/0	4/0
90	8	6	4	4	2	2	1	0	0	2/0	2/0	3/0	3/0	4/0	4/0	4/0	4/0	4/0	
100	6	6	4	4	2	2	1	0	2/0	2/0	3/0	3/0	4/0	4/0	4/0				

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WARNING!

Not winterizing the Aqua-Hot when freezing temperatures are present will result in serious damage to the Aqua-Hot's Domestic Water Heating System. Also, be sure to use an FDA approved, "GRAS" rated antifreeze for winterization.

NOTE: The Aqua-Hot can continue to be used for interior zone heating once the domestic water heating system has been drained and winterized.

The Aqua-Hot's Domestic Water Heating System must be completely drained of domestic water any time the heater is stored where freezing temperatures may be experienced.

Winterizing the Domestic Water Heating System:

Please follow these instructions when winterizing the Aqua-Hot's Domestic Water Heating System; reference Figure 89:

1. Completely drain the fresh water storage tank.
2. Disconnect the domestic water demand pump's suction line from the fresh water storage tank.
3. Attach an adequate piece of hose onto the suction side of the domestic water demand pump.
4. Place the opposite end of the hose into an adequate supply of FDA-approved "GRAS" RV Antifreeze.
5. Open and close all interior and exterior water faucets, one at a time, until only pure RV Antifreeze is present. Perform this procedure for both the hot and cold faucets.
6. Remove the hose and reconnect the domestic water demand pump's suction line to the fresh water storage tank.

WARNING!

An FDA approved "GRAS" rated winterization antifreeze must be used. YOU CANNOT BLOW DOMESTIC WATER COIL OUT WITH AIR TO WINTERIZE AQUA-HOT.

De-Winterizing the Domestic Water Heating System:

For de-winterization, completely fill the fresh water storage tank. Open and close all interior and exterior water faucets, one at a time, until only clear water is present/visible.
Reference Figure 8.

If disinfecting the potable water system after de-winterizing, be sure to follow RVIA's "**Instructions for Disinfection of Potable Water Systems on Recreation Vehicles**." These instructions can be obtained by contacting the Recreational Vehicle Industry Association at **(703) 620-6003**, visiting them online at **www.rvia.com**, or writing to them at the following address:

Recreation Vehicle Industry Association
1896 Preston White Drive
P.O. Box 2999
Reston, VA 20195-0999

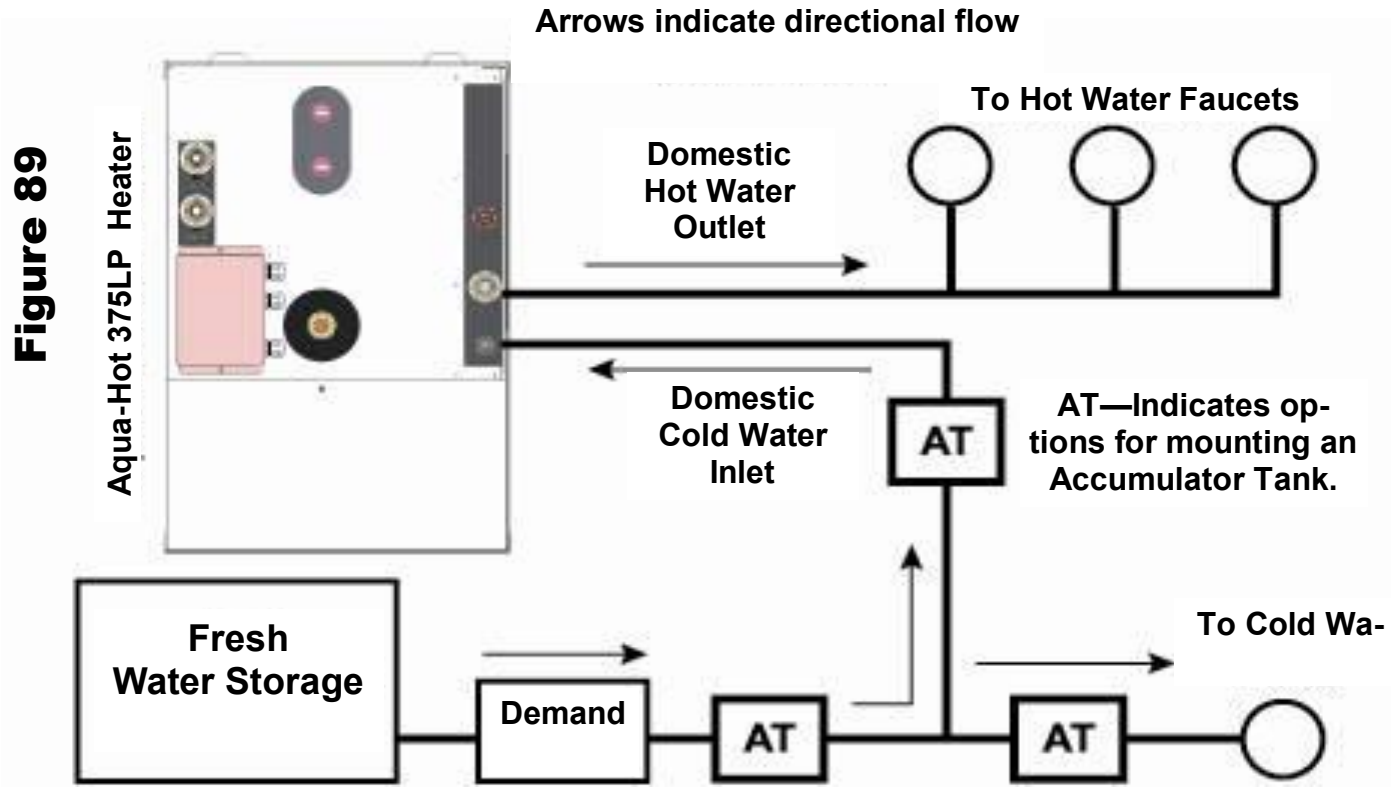

Figure 89

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WARNING!

When storing the Motor home: Not winterizing the Aqua-Hot when freezing temperatures are present will result in serious damage to the Aqua-Hot's Domestic Water Heating System. Also, be sure to use an FDA approved, "GRAS" rated antifreeze for winterization.

NOTE: The Aqua-Hot can continue to be used for interior zone heating once the domestic water heating system has been drained and winterized.

120 Volt-A.C. Electric Heating Element

Please note that the 120 Volt-AC Electric Heating Element is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water).

If the 120 Volt-AC Electric Heating Element is not providing enough heat, turn the Propane-Burner on, in conjunction with the 120 Volt-AC Electric Heating Element.

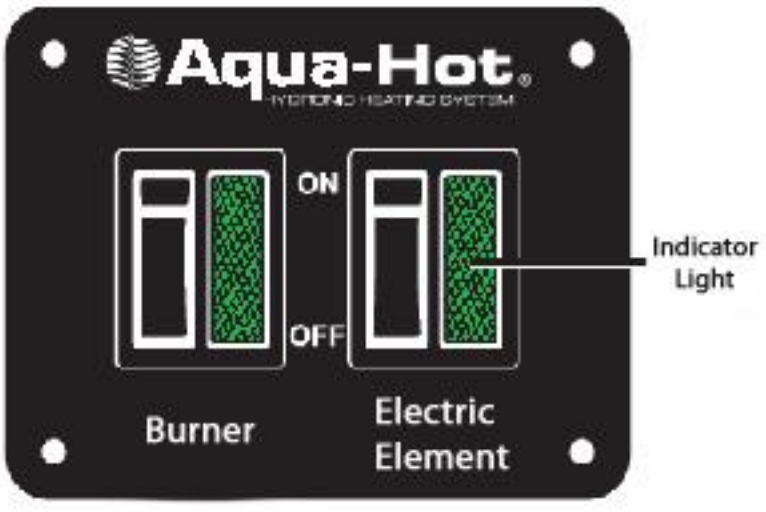
Propane-Burner

1. If the Propane-Burner Fails to operate:

   A. Is there propane in the motor home?

NOTE: In extreme cold weather it may be necessary to activate the 120 Volt-A.C. Electric Heating Element for 1 - 2 hours prior to activating the burner to preheat the burner, on the initial start up cycle only.

Figure 90



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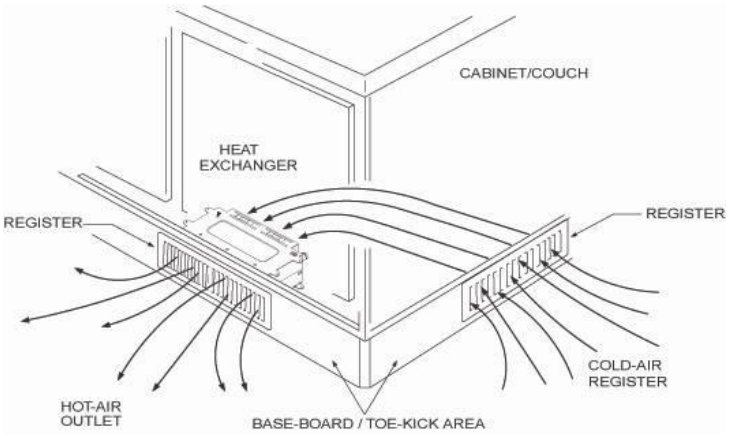
If there is a lack of interior Heat:

Note: The 120 Volt-AC Electric Heating Element is the Aqua-Hot's **secondary heat source** for heating both the interior and/or the domestic hot water during low heating demand situations (such as when moderate ambient temperatures exist and/or when there is a low demand for domestic hot water). If the ambient temperature is ex-

1. Is the Propane-Burner activated?
2. Is the Propane-Burner operating Properly?
3. What is the antifreeze concentration, inside of the Aqua-Hot Boiler Tank?
4. Was the heating system properly installed, following the 375 LP installation manual?
    A. Are there at least 5 heat exchangers installed in the Interior of the motor home?
    B. Are there cold air returns installed for every heat exchanger? Reference Figure 92.
    C. Are the heat exchangers mounted as close to the hot air outlet grill as possible? Reference Figure 91.

Figure 91



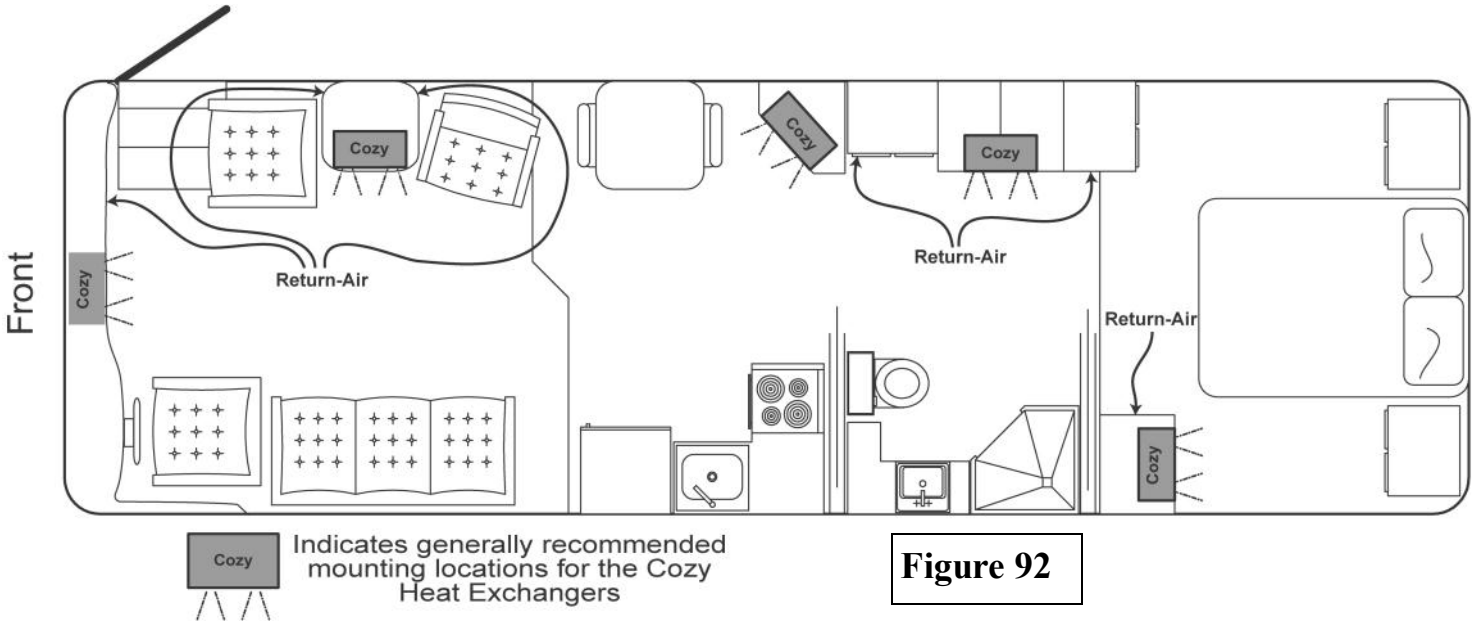


Figure 92

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PROPANE Aqua-Hot®

HYDRONIC HEATING SYSTEM

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SERVICE MANUAL

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